Outline Specification

Due to continued product improvement, this specification is subject to change without prior notice.

GENERAL

Number of Programmes	500
Control buttons	Standby, Programme Up/Down buttons
UHF Modulator	CCIR PAL System I (System G in PRIMA MULTICHOICE), Ch. 21 to 69, preset to Ch. 38
Operating Voltage	230 V AC, 50 Hz
Power Consumption	18 W (max.) optional 10 W typical in low-power standby.
Dimensions	H = 68 mm, W = 360 mm, D = 225 mm approx.
Weight	1.95 kg (typical, when packed)

CONNECTORS

TV	SCART (CVBS, RGB looped from decoder SCART)
R & L (audio out)	Phono
MAINS INPUT	2-pin reversible
AERIAL	IEC female
TV	IEC male
LNB	Dual F type
VIDEO RECORDER	SCART (CVBS)
DECODER	SCART (Baseband Output, Audio/Video Input/Output, RGB in)

TUNER

Receiving Frequency Range	700 – 2150 MHz
Polarity Switching	Vertical: 12.0 – 14.0 V, Horizontal: 17.0 – 20.0 V at 0 – 400 mA with short circuit protection
LNB Switching	Tone (DiSEqC v1.0) Amplitude: 0.0.6V±0.2V Frequency: 22 kHz±2 kHz
Input Impedance	75 Ω
I. F.	479.5 MHz
I. F. Bandwidth	15 MHz/27 MHz software selectable
Input Level	–60 dBm to –30 dBm
Image Rejection	40 dB (typically)
Static Threshold	6 dB (typically)
Energy Dispersion Removal	35 dB (min.)

SCART CONNECTORS

Video Output Level	1 V p-p (±2 dB) into 75 Ω load.
Video Output Impedance	75 Ω
Video Frequency Range	50 Hz – 4.8 MHz (±3dB)
Video De-emphasis (PAL)	to CCIR 405.1 (625 lines)
Baseband Output Level	1 V p-p (±2 dB) into 75Ω load
Baseband Frequency Range	30 Hz – 10.5 MHz (±3 dB) (Flat)
Baseband De-emphasis	PAL/Clamped/Flat, software selectable
Audio Frequency Range	30 Hz – 12 kHz
Audio Output Level	500 mV RMS into 10 k Ω

OPERATING/STORAGE CONDITIONS

Operating Temperature Range	5 – 40 °C
Storage Temperature Range	–20 – +50 °C

AUDIO

Audio Bandwidth	130, 180, 200, 280, 380, 500 or 600 kHz
Audio De-emphasis	PANDA 1, 50 µs, 75 µs or J17
Tuning Frequency Range	5.00 – 9.00 MHz in 10 kHz steps, left and right frequencies are independently tunable.
Modes	Mono, Stereo.

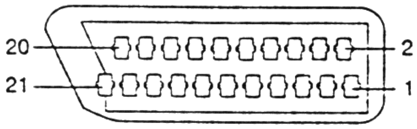
AUDIO

KU-Band preset audio modes

Mode	Frequency	De-emphasis	Bandwidth
Stereo A	7.02 & 7.20 MHz	PANDA 1	130 kHz
Stereo B	7.38 & 7.56 MHz	PANDA 1	130 kHz
Stereo C	7.74 & 7.92 MHz	PANDA 1	130 kHz
Stereo D	8.10 & 8.28 MHz	PANDA 1	130 kHz
Mono 1	6.50 MHz	50 µs	200 kHz
Mono 2	7.02 MHz	PANDA 1	130 kHz
Mono 3	7.20 MHz	PANDA 1	130 kHz
Mono 4	7.38 MHz	PANDA 1	130 kHz
Mono 5	7.56 MHz	PANDA 1	130 kHz
Mono 6	7.74 MHz	PANDA 1	130 kHz
Mono 7	7.92 MHz	PANDA 1	130 kHz
Mono 8	8.10 MHz	PANDA 1	130 kHz
Mono 9	8.28 MHz	PANDA 1	130 kHz
Mono 10	6.55 MHz	50 µs	200 kHz

PIN DESIGNATIONS FOR SCART CONNECTORS

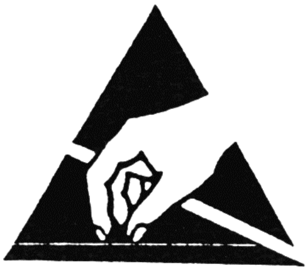
Socket Viewed from Rear Panel



Pin	TV SCART	Pin	VCR SCART	Pin	DECODER SCART
1	R Audio Out	1	R Audio Out	1	R Audio Out
2	Not connected	2	R Audio In	2	R Audio In
3	L Audio Out	3	L Audio Out	3	L Audio Out
4	Audio Ground	4	Audio Ground	4	Audio Ground
5	Blue Ground	5	Ground	5	Blue Ground
6	Not connected	6	L Audio In	6	L Audio In
7	Blue Out	7	Not connected	7	Blue In
8	AV Status Out	8	VCR Status In	8	Ext. Decoder Status In
9	Green Ground	9	Ground	9	Green Ground
10	Serial Data I/O port	10	Not connected	10	Not connected
11	Green Out	11	Not connected	11	Green In
12	Serial Data I/O port	12	Not connected	12	Serial Data I/O Port
13	Red Ground	13	Ground	13	Red Ground
14	Ground	14	Ground	14	Ground
15	Red Out	15	Not connected	15	Red In
16	RGB Status Out	16	Not connected	16	RGB Status In
17	Video Ground	17	Video Ground	17	Video Ground
18	Ground	18	Ground	18	Ground
19	Video Out	19	Video Out	19	Baseband Video Out
20	Not connected	20	Video In	20	Video In
21	Ground (Casing)	21	Ground (Casing)	21	Ground (Casing)

Working with Chip Components

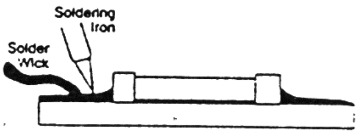
ELECTROSTATIC SENSITIVE (ES) DEVICES

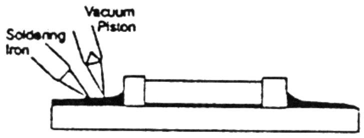


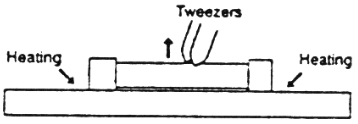
Many semiconductor devices, such as integrated circuits and field effect transistors, can easily be damaged by static electricity. The following precautions should be observed when ES devices are being handled.

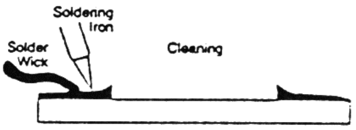
- Always use a grounded tip soldering iron and anti-static type solder removal devices.
- Before handling a device, discharge any electrostatic charge on your body by touching a known earth point - preferably use an earthed bench mat or ground mat together with a wrist strap.
- Do not remove an ES device from its protective packing until you are ready to fit it. Touch the protective material to the chassis or the assembly in which the ES device is to be installed, before removing the device from its packing.

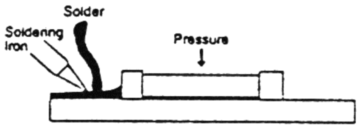
GENERAL PRECAUTIONS WHEN HANDLING CHIPS

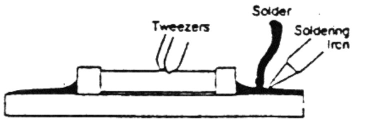


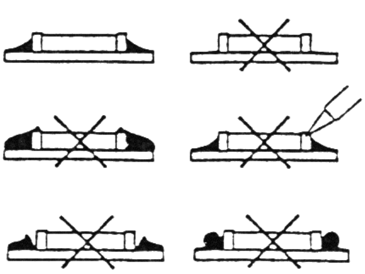












Do not handle chips with your bare hands as this causes oxidation on the chip's terminals which leads to poor soldering.

Do not store the chips in any of the following , as oxidation occurs and capacitance and resistance are affected i.e. areas with sulphur or chlorine gas; direct sunlight and areas of high temperature and/or high humidity.

Rough handling of circuit boards containing surface mount devices can cause damage to the components and the board; never bend or flex boards.

Do not heat or cool the boards unnecessarily, as the board materials expand and contract by differing amounts which can cause the components and solder connections to be stressed.

Never rub or scrape chip components as this can change their value. Do not slide the board across any surface.

When using a soldering iron, take care and apply suitable pressure.

For preference, use a soldering iron rated at approx. 30 W with a thermostatic control to give soldering temperatures of approx. 225 to 250 °C.

Do not re-use any chips removed from the board.

When attaching chips, solder as quickly as possible so as not to damage the terminals and body of the chip. Do not touch the terminals directly with the soldering iron.

While soldering, keep the chip's body in contact with the board.

Attaching a Chip

Place the chip in the correct position and temporarily solder one terminal to the copper surface.

Holding the chip body with a pair of tweezers to position it accurately, complete the soldering at each terminal in turn.

Removing a Chip

Heat the solder for 2 to 3 seconds at each terminal of the chip. Remove the molten solder with solder wick.

Holding the chip with a pair of tweezers, remove it gently from the board while the solder at each terminal is molten.

Wick off all excess solder from the board, so that it is ready for new components.

Circuit Description

The receiver comprises a single main PCB. Circuit diagrams are in the pocket on the rear cover.

The adjacent "main" block diagram shows the main functional blocks.

TUNER AND VIDEO PROCESSING

Tuner

When a programme is selected via the handset, data received by the sensor IR 1 is fed, as TTL level data, to the microprocessor U700. In turn U700 supplies tuning data to a frequency synthesiser U100. The synthesiser forms the reference oscillator for the phase locked loop which controls the local oscillator in the tuner. The prescaler output of the tuner is obtained by dividing the local oscillator frequency by 128.

The local oscillator is set 479.5 MHz higher in frequency than the chosen programme and is mixed with the incoming signal. The signal is then amplified by an IF stage centred at 479.5 MHz with a bandwidth of 27 MHz. The 479.5 MHz FM signal is then demodulated in the tuner to give the required composite video baseband signal (CVBS) output.

The frequency synthesis is performed by U100 which receives divider ratio data for the required programme via the 3-wire serial bus from the microprocessor U700. The data is on pin 5, clock on pin 4 and select on pin 3 of U100. The synthesiser generates a reference frequency from the 5.625 MHz crystal (X100) input on pins 1 and 2. The prescaler input on pin 11 of U100 is divided down according to the divider ratio sent from U700 and compared with the generated reference. The error signal from the phase locked loop (pulses on pin 14 of U100) is integrated by Q100 and associated components. These determine how much of the 30 V supply appears as the tuner control voltage on pin 15 of the tuner. The 5V supply to the tuner is on pin 12.

To compensate for the LNB's local oscillator frequency conversion offsets, information on the position of the signal relative to the 27 MHz bandpass filter within the tuner passes from pin 10 of TUNER100 to pin 35 of U700. The frequency synthesised within U100 is then varied under control from U700. This automatic frequency control (AFC) keeps the signal central in the 27 MHz bandpass filter.

In dual-input models of the receiver, the Tuning Menu can be used to specify whether a programme is received via LNB 1 or LNB 2. The line LNB_SELECT controls both the supply and select for the LNBs and comes from pin 21 of U700. Pin 4 of the tuner is the select line for LNB1 and it is enabled by Q106; pin 6 is the select line for LNB 2 and it is enabled by Q107. Power to the LNBs passes through the tuner via pin 3 for LNB 1 and pin 5 for LNB 2. There are further details about the LNB supply in the SMPS circuit description on page TBA.

The baseband signal from pin 13 of the tuner is filtered by R110, C112, C113 and L100 which form a low pass filter. It is then buffered by emitter follower Q101 and AC coupled by C548 into the video input (pin 20) of the sound and video processor and switch matrix (U500). The baseband signal from U101 emitter is also filtered by C556, C555, C549, R539, R538 and L503, which form a high pass filter to remove the video. The resulting audio subcarriers go to the FM input (pin 23) of the sound and video processor (U500).

Dual Bandwidth Tuner

The bandwidth of the tuner is controlled by the BANDWIDTH control line which comes from the microprocessor U700 via the I²C bus to pin 14 of the modulator chip U200. This pin is an open collector output and must have the pull up resistor R112 fitted to function properly.

Receivers with a dual bandwidth tuner have a contrast option in the Set Up Programme Menu to adjust the video level. Satellites other than Astra transmitting with a deviation of 22 MHz/V against 16 MHz/V from Astra will have larger video levels from the tuner. The video level adjustment is achieved by the variable gain amplifier inside U500 and the software when the appropriate contrast selection is made.

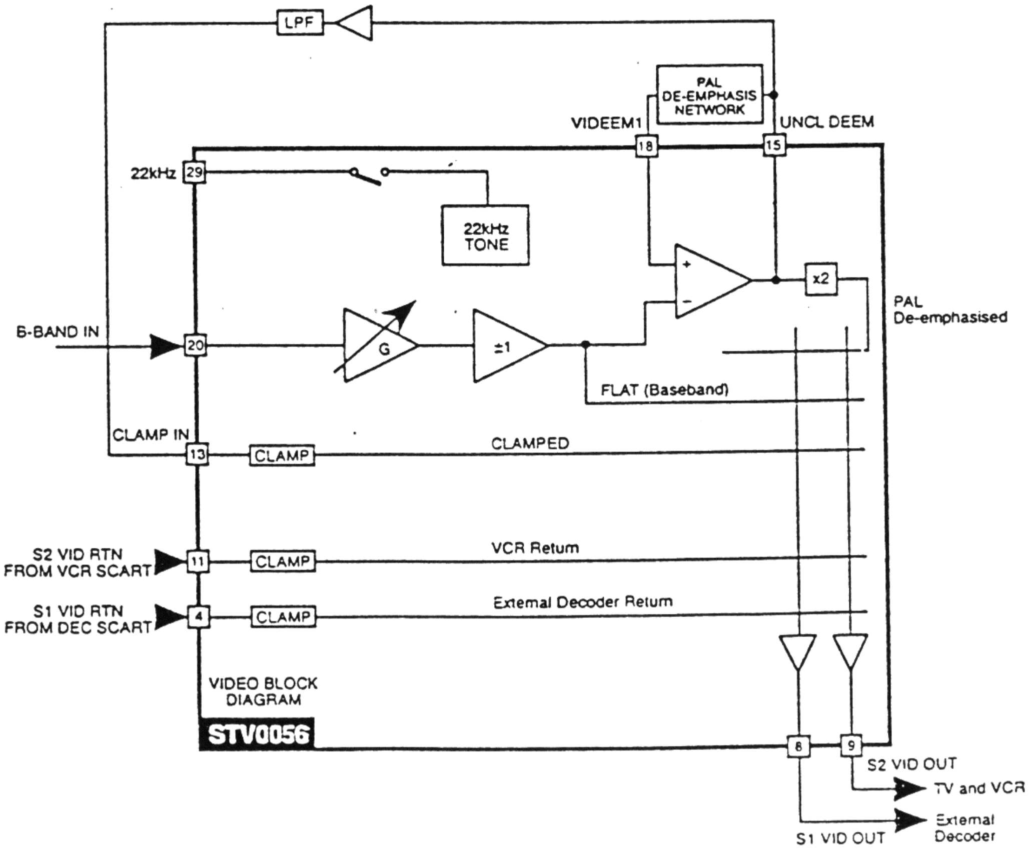
Video processing within U500

The baseband enters U500 at pin 20 where there is a variable gain video amplifier whose output can be selected to be normal or inverted (for C-Band video). This signal is also further processed in U500 by a second amplifier and the network connected between pins 15 and 18 (via L501, L502, L504 and associated components) for PAL de-emphasis. The output of the first amplifier provides an input to the onboard 6 x 3 video switch which is called FLAT (since it has no de-emphasis). The output of the second amplifier also provides an input to the video switch matrix which is called PAL (since it is PAL de-emphasised). The output at pin 15 also undergoes group delay compensation by Q500, Q501 and associated components. The signal then re-enters U500 at pin 13 where the energy dispersal is removed by a sync. tip clamping circuit. Most satellite signals are transmitted with energy dispersal to distribute the energy more evenly across the transmission bandwidth. Energy dispersal is a triangular 25 Hz waveform added to the signal. If it is not removed, flickering can occur on the screen. The signal on pin 13 provides an input to the switch matrix which is called CLAMPED. The three other inputs to the switch matrix (U500) are INTERNAL DECODER RETURN, VCR RETURN and EXTERNAL DECODER RETURN.

The TV SCART is switched between CLAMPED, INTERNAL DECODER RETURN, VCR RETURN and EXTERNAL DECODER RETURN depending on the status of VCR_PIN_8 and DEC_PIN_8.

The decoder SCART video options are limited to PAL, FLAT or CLAMPED in the Set Up Programme Menu.

The VCR SCART video will be CLAMPED, INTERNAL DECODER RETURN or EXTERNAL DECODER RETURN depending upon the status of DEC_PIN_8.


LPF
PAL
DE-EMPHASIS
NETWORK
VIDEEM1
UNCL DEEM
18
15
22kHz
29
22kHz
TONE
+
-
x2
PAL
De-emphasised
B-BAND IN
20
G
±1
FLAT (Baseband)
CLAMP IN
13
CLAMP
CLAMPED
S2 VID RTN
FROM VCR SCART
11
CLAMP
VCR Return
S1 VID RTN
FROM DEC SCART
4
CLAMP
External Decoder Return
VIDEO BLOCK
DIAGRAM
STV0056
8
9
S2 VID OUT
TV and VCR
External
Decoder
S1 VID OUT

Colour Graphics Generator (U600)

The video signal at pin 9 of U500 is already clamped at the correct level for the graphics chip and so no buffer is required. R601 and D600 limit the amplitude of the video to less than 5 V, as with noisy signals the video amplitude could exceed 5 V and break through the blue screen menus.

U600 and associated components form the graphics generator which is used to generate the menu background colour and on-screen text characters, under control from the microprocessor U700. The background colour is fixed to blue. There are two graphics modes: plain background and superimposed on a picture.

There are two oscillators associated with U600. The first oscillator is the crystal X600 which generates a frequency of 17.734 MHz. This is exactly four times the frequency of the colour information and is used to generate the background colour, it is therefore only relevant to plain background mode. If this frequency is not within one hundred hertz of 17.734 MHz, there may be no background colour for the on-screen graphics display (it depends on the tolerance of the TV set). The second oscillator is in U600 runs at approximately 7 MHz, its frequency set by external components L602, C609 and C610. This is used, together with horizontal and vertical sync. pulses, to generate the characters and their positions on the screen. For the superimposed on picture mode the horizontal and vertical sync. pulses enter U600 at pins 18 and 19 respectively. For plain background mode the horizontal and vertical sync. pulses are generated within U600. For both these modes, the white level for the characters is set by resistors R603 and R604.

The video signal which enters U600 at pin 10 therefore emerges at pin 8 with any superimposed graphics such as menus, programme status information etc.

The main microprocessor U700 analyses the horizontal sync. pulses which pass via link J602 to enter U700 at pin 39 (line STN_ID). U700 can detect the presence of a 15.625 kHz signal and, if it detects this signal, it follows that there must be a valid signal ("station") which is generating the sync. pulses. The microprocessor U700 has a certain amount of hysteresis in its decision-making so that it can analyse noisy signals.

U700 then commands U600 to superimpose graphics onto a picture for the Set Up Programme Menu (and similar menus). However, if you press the TV/SAT key while the menu is displayed, U700 commands U600 to insert a plain blue background instead of the picture.

Note that part of U600 is also used as a port expander for U700.

TV SCART

The video output at pin 8 of U600 is buffered by emitter follower Q601 and then output via R611 at pin 19 of the TV SCART. The emitter follower also supplies video to the UHF modulator. Both the TV SCART and the modulator outputs have on-screen graphics.

VCR SCART

The video signal at pin 9 of U500 is buffered by the emitter follower Q600 and then output via R623 at pin 19 of the VCR SCART. There are no on-screen graphics on the VCR SCART.

Decoder SCART

The video signal at pin 8 of U500 is buffered by the emitter follower Q605 and then output via R618 at pin 19 of the DECODER SCART. There are no on-screen graphics on the DECODER SCART.

➡

Output to the Modulator

The video from the emitter of Q601 at R611 on the TV SCART is fed via the link R901, a filter comprising C202, C213, C214 and R216 to the UHF modulator. Resistors R214 and R215 attenuate the video to 500 mV pk to pk.

Note that this video to the modulator contains on-screen graphics which will be recorded if a VCR is connected to the receiver by a UHF lead. (Video to the VCR SCART, when fitted, does not contain on-screen graphics.)

RGB Disable Switch

If an external MAC decoder is connected to the decoder SCART and set to RGB output, the Red, Green and Blue signals are simply looped from the decoder SCART to the TV SCART. Pin 16 of the decoder SCART is buffered to the TV SCART by Q603. When pin 16 of the TV SCART is 0 V the TV is in PAL mode, when pin 16 of the TV SCART is at 5 V the TV is in RGB mode. Pin 16 of the decoder SCART is disabled by the microprocessor U700 switching on Q602. This pulls the base of Q603 to ground which in turn switches pin 16 of the TV SCART to 0 V therefore disabling the TV's RGB function. RGB disable is performed when in menus, because the menus are PAL only.

UHF MODULATOR

The RF output to the TV is generated by a frequency synthesisied UHF modulator. This allows the RF output to be precisely tuned to any channel within the UHF bands IV and V (channels 21 to 69).

The circuitry consists of two main parts, a loop-through amplifier (U201) between the aerial input and the output to the TV/VCR, and the UHF modulator itself, which comprises U200 and associated components.

The heart of the modulator is the IC U200, a block diagram of which is shown on page 10. It comprises the following:

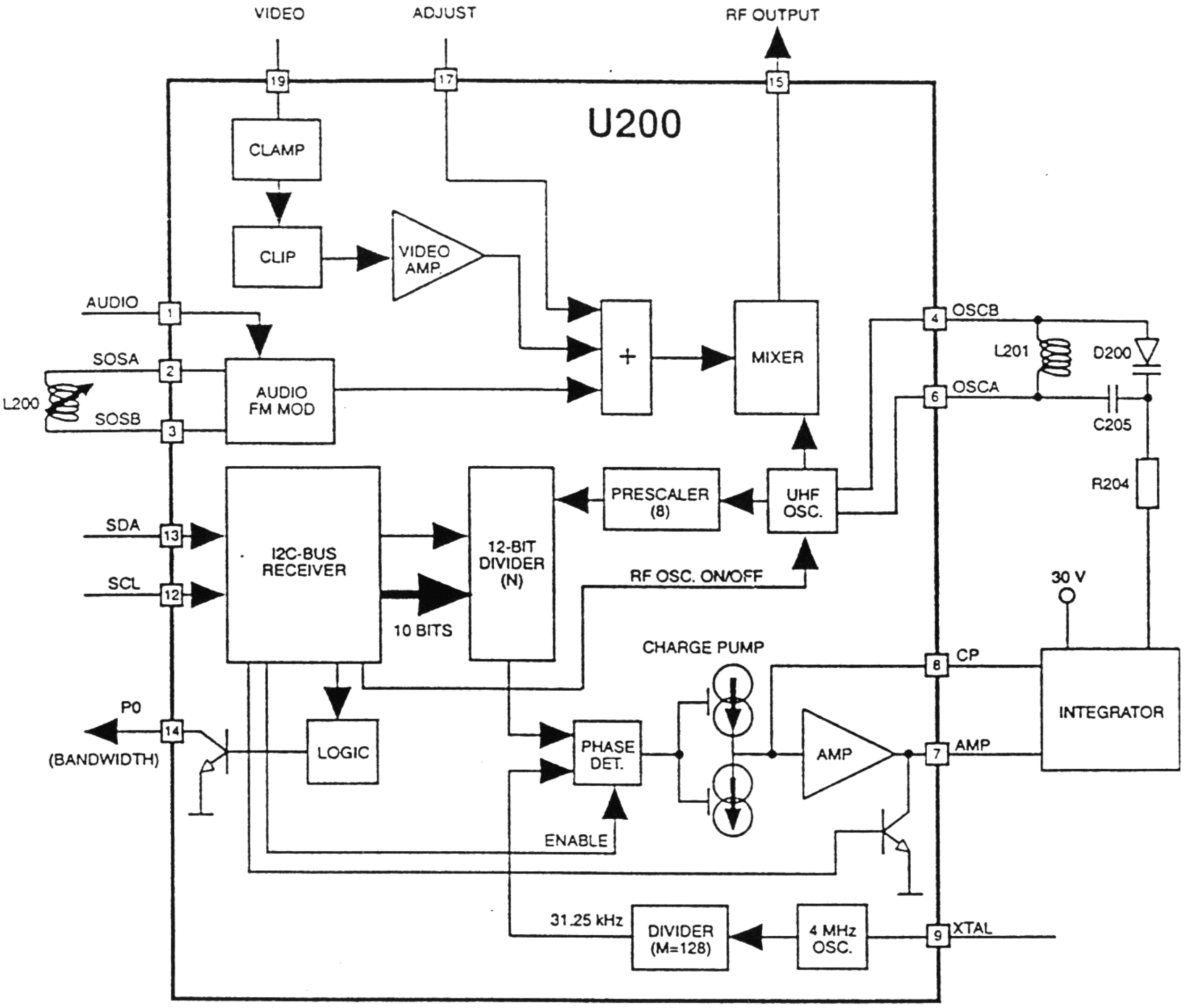
- a phase locked loop frequency synthesiser that covers the full UHF band;
- an amplitude modulator to modulate the UHF carrier with the video;
- an audio oscillator for the sound subcarrier;
- a video clamp to ensure the correct modulation index.

Tuning is performed by applying a DC tuning voltage in the range 0.7 to 24 V to the cathode of the varicap diode D200. This tuning voltage is derived from the error pulses on pin 7 of U200 which are integrated by Q200, R207, R206, C208 and C209 and associated circuitry.

The audio subcarrier oscillator tuned circuit is connected across pins 2 and 3 of U200. This is set at the audio subcarrier frequency (6 MHz for PAL I; 5.5 MHz for PAL G). The audio signals from pins 6 and 10 of the audio processor section of U500 are combined by R523 and R524, AC coupled by C200, pre-emphasised by C201 and R200 and then input at pin 1 of U200. The audio level at this point should be approximately 500 mV pk to pk at full volume. Note that the outputs at pins 6 and 10 of U500 are also fed to the TV SCART, so that the modulator always has the same audio source as the TV SCART.

The video signal (labelled GRAPHICS_OUT in the circuit diagram) passes via L202, which, together with C213 and C214, forms a low pass filter. Resistor R214 and R215 attenuate the video to 500 mV pk to pk. The video signal is fed into pin 19 of U200. This is used to amplitude modulate the VCO output. The modulation index is set to be 80% by resistor R213 on pin 17 of U200.

The RF output from pin 16 of U200 is fed via C216 and R212 into U201 an RF loopthrough amplifier chip which mixes the signal with the terrestrial RF channels. When the satellite receiver is in standby the UHF oscillator is switched off by U200 under control of the microprocessor U700 via the I^{2}C bus.


VIDEO
ADJUST
RF OUTPUT
19
17
15
U200
CLAMP
CLIP
VIDEO AMP.
AUDIO
1
SOSA
2
L200
SOSB
3
AUDIO FM MOD
+
MIXER
4
OSCB
L201
D200
6
OSCA
C205
R204
PRESCALER (8)
UHF OSC.
SDA
13
SCL
12
I2C-BUS RECEIVER
12-BIT DIVIDER (N)
10 BITS
RF OSC. ON/OFF
30 V
CHARGE PUMP
8
CP
INTEGRATOR
P0
14
(BANDWIDTH)
LOGIC
PHASE DET.
AMP
7
AMP
ENABLE
31.25 kHz
DIVIDER (M=128)
4 MHz OSC.
9
XTAL

The port output bit on pin 14 of U200 is used to control the bandwidth of the tuner. Since this pin is an open collector output it must have a pull-up resistor (R112) to function properly.

Mains Input and Rectification

Diodes D1, D2, D3 and D4 rectify the AC mains voltage and, together with smoothing capacitor C3, provide the DC input HT for the SMPS. R1 provides inrush current limiting to protect the diode bridge. C1 and T1 form a mains filter to minimise the feedback of RFI into the mains supply. Asymmetrical mains pollution is reduced by the insertion of C6 between the primary ground and the secondary chassis ground. This component is required to satisfy the mains isolation requirements and is a safety-critical component (as are SK1, FS1, and T2). These components must only be replaced by components of the correct type (see parts lists).

SMPS Controller U1

U1 is a single chip T0220 switch mode power supply IC. It runs at approx 100 kHz. R2 and C4 determine the loop response and the power-up delay. Feedback from the sense winding (pin 7 and pin 9) is rectified by D8, R3 and C5 to provide a DC voltage which determines the DC outputs. When this voltage is greater than approximately 21 V current flows through D7 into the control pin of U1 reducing the switch-on time of the device hence keeping the power supply in regulation.

D20 and D6 form a snubber network to limit the back EMF of T2 from rising above the 700 V breakdown voltage of U1.

Secondary Windings of T2

The secondary windings of the transformer T2 provide the following voltages after rectification and smoothing: +5 V (pin 12), +17 V (pin 8), +22 V (pin 2), and +29 V (pin 4). The 17 V provides the vertical supply for the LNB and is also sub-regulated by U3 to 12 V to provide power for U500 and U302 as well as some of the video circuitry.

The 22 V is used for the horizontal LNB supply; the 30 V is used to provide tuning volts for the modulator U200 and the tuner.

LNB Supply Switching

U2A and Q2 act as a programmable linear regulator to provide accurate, regulated LNB outputs. A reference voltage from D17 and the potential divider R26 and R28 (altered by Q8 switching in R29) is applied to pin 3 of U2A. The output of the operational amplifier U2A will switch on Q2 until the voltage on pin 2 of U2A is the same as the voltage on pin 3. Components R18 and R19 are in the ratio of 5:1 hence 3 V on pin 3 will provide approximately 15 V on the LNB supply. Q3, R16 and R17 provide current limit at 450 mA to protect Q2 and the power supply. D15, Q4 and associated components provide LNB short circuit protection. If the LNB supply drops below 10 V the transistor Q4 is turned off and the LNB_MON signal is detected by the micro controller U700. The LNB supply can be turned off by turning on Q7 which holds pin 3 of U2A at 0 V and hence the output at 0 V.

To reduce dissipation, the horizontal or vertical voltage to Q2 is switched by Q5, Q6, Q1 and associated components.

By adding a 22 kHz tone via R24, R25 and C23 to pin 3 of U2A a 22 kHz tone can be superimposed on the LNB supply.

Power Supplies during Standby

The receiver has a low power mode. If this is set at the Power-on Options then the LNB supply is turned off and both U200 and U500 are placed in low power mode thus reducing the power taken by the receiver when in standby to approximately 10 W. If this option is not set then in standby the LNB is still powered, which is necessary in very cold climates. However U200 and U500 are still placed in low power mode.

SYNC. SEPARATOR

The sync. separator comprises Q606, Q607, Q608, Q609 and associated components. Transistor Q606 is a buffer driver for the sync. separator.

Q607 is lightly biased by R635, but, in the presence of a clamped video signal coming in via C616, the positive-going video signal switches off Q607 by reverse biasing its base. When the negative-going sync. pulses arrive however, these switch Q607 hard on so that only the sync. pulses appear at the collector of Q607. The video signal is therefore stripped off to leave the sync. pulses.

The horizontal sync. pulses (HSYNC) are then inverted and buffered by Q608. A low-pass filter comprising R638 and C618 with R640 and R641 extracts the vertical sync. pulses (VSYNC), which are then inverted and buffered by Q609.

The Station ID is done via the microprocessor U700, which performs this function by analysing the horizontal sync. pulses which pass via link J602 to enter U700 at pin 39 (line STN_ID). U700 can detect the presence of a 15.625 kHz signal and, if it detects this signal, it follows that there must be a valid signal ("station") which is generating the sync. pulses. The microprocessor U700 has a certain amount of hysteresis in its decision-making so that it can analyse noisy signals.

CONTROL CIRCUITRY AND DISPLAY

U700 Functionality

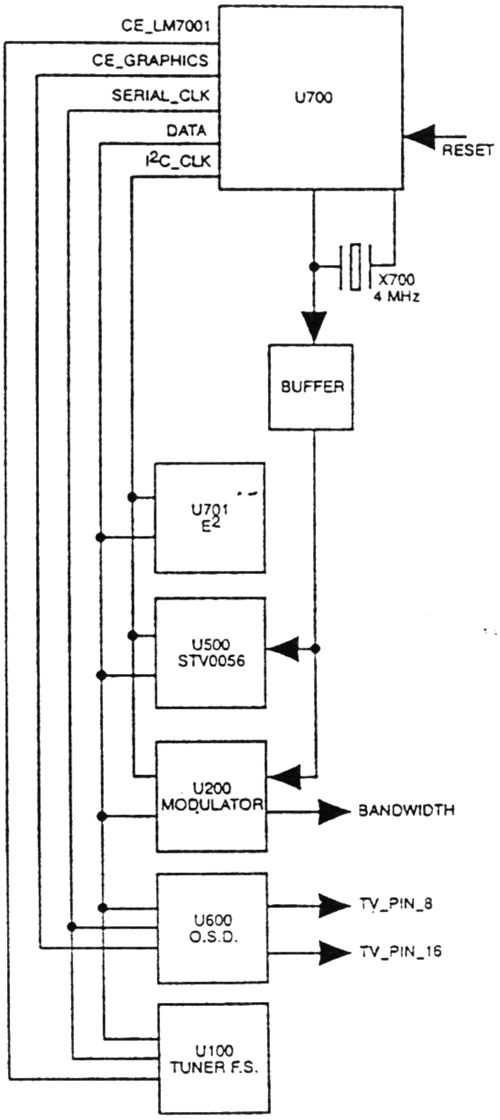
U700 runs at 4 MHz with a clock generated by crystal X700 and performs the following:

- it decodes the signals received from the IR module via the IR beam from the handset and those from the top panel buttons;
- it controls and sends text to the on-screen graphics IC;
- it controls the UHF modulator and tuner frequency synthesis PLL;
- it controls the routing of the video and audio signals;
- it controls other switching functions such as the LNB supply switching;
- it activates the front panel LEDs.

U701 is an E^{2}PROM which is used to store custom information which is set at the on-screen menus and is preloaded with default settings by a factory download. The graphics generator IC U600 acts as a port expander for the control lines TV_PIN_8 and TV_PIN_16. The modulator chip U200 acts as a port expander for the control line bandwidth.

Control Lines

A block diagram of the serial bus interconnections is shown right. Some of U700's control functions occur via these lines; others have specific control lines which are described at the relevant points in the circuit descriptions. Some lines (e.g. LNB_MON) are inputs to U700 to inform it of conditions arising in the hardware. The line DEC_PIN_8 is an input which informs U700 that pin 8 of the DECODER SCART has gone high. The line VCR__PIN_8 is described on page 13. The TV_PIN_8 line is always an output from U700 and is also mentioned on page 15.



Reset

A reset is applied to the microprocessors within the unit (U700) when the +5 V supply is below approximately 4.75 V. A precise 5.1 V reference is generated by D17 and is divided by R34 and R35 to give a 4.77 V reference to pin 5 of U2 which is acting as a comparator. If the 5 V supply at pin 6 drops below 4.77 V, the comparator output will fall to 0 V. This in turn switches on Q9 which shorts C33 to ground and so the $\overline{\text{RST}}$ reset line is held low. $\overline{\text{RST}}$ stays low until pin 5 of U2 rises above 4.77 V.

AUDIO DEMODULATION AND DE-EMPHASIS

All of these functions are carried out by the audio/video processor and switch matrix chip U500. The baseband input from the emitter of Q101 is filtered by C556, C555, L503, R539 and R538 which form a simple high pass filter with a chroma trap at 4.43 MHz. This strips most of the video off the baseband and the filtered signal enters U500 at pin 23. All functions are then carried out within the chip under control of the microprocessor U700.

PERIPHERAL COMPONENTS AND CONTROL LINES

U500 is controlled via the I^2C clock and data on pins 30 and 31 respectively. It needs a 47.5 kΩ 1%resistor (if STV0056A is fitted) or a 237 kΩ 1% resistor (if STV0056 is fitted) between pin 50 and ground to produce an accurate current reference for biasing of the amplifiers within the chip and provide accurate roll-off frequencies for the audio filters. If this resistor is the wrong value or missing U500 will not function. There is one general purpose Input/Output port on pin 29 which is used as a 22 kHz source for the tone switching option (see page 11).

AUDIO BASEBAND PROCESSING AND SIGNAL ROUTING

The desired subcarrier frequency is set by loading a programmable divider in the frequency synthesiser which sets the frequency of an internal local oscillator. When the frequency is reached the microprocessor (U700) switches in a PLL and demodulation starts.

The AMPLKL and AMPLKR, pins 41 and 46, are amplitude detectors which measure approximately 3 V DC when locked to a subcarrier and measure 1.5 V DC when no carrier is present.

The DETL and DETR, pins 47 and 39, are the output of the left and right FM phase detectors and have audio superimposed on approximately 180 kHz. The 180 kHz is a beat frequency which appears when two subcarriers spaced by 180 kHz are input to the PLL.

The CPUMPL and CPUMPR, pins 38 and 49, are the output of the frequency synthesiser which drives the voltage to pull the VCO to the target frequency. As the audio frequency is increased, the voltage on the CPUMP pins increases.

The PKOUTL and PKOUTR, pins 52 and 51, form the PANDA control loop peak detector. The DC level on these pins rises during loud passages of audio and falls during quiet passages.

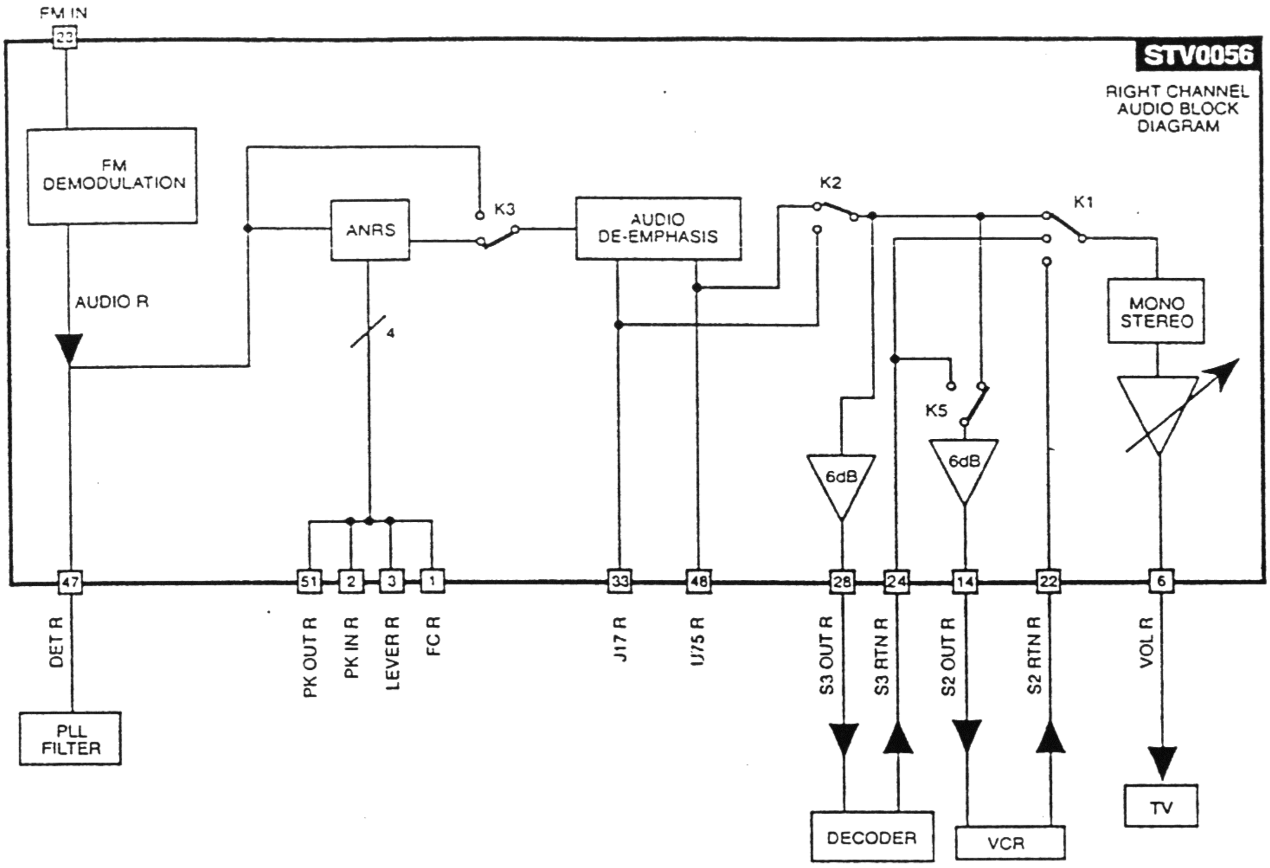
The FCL and FCR, pins 55 and 1, define the min/max roll off frequencies repectively. Audio can be seen on these pins.

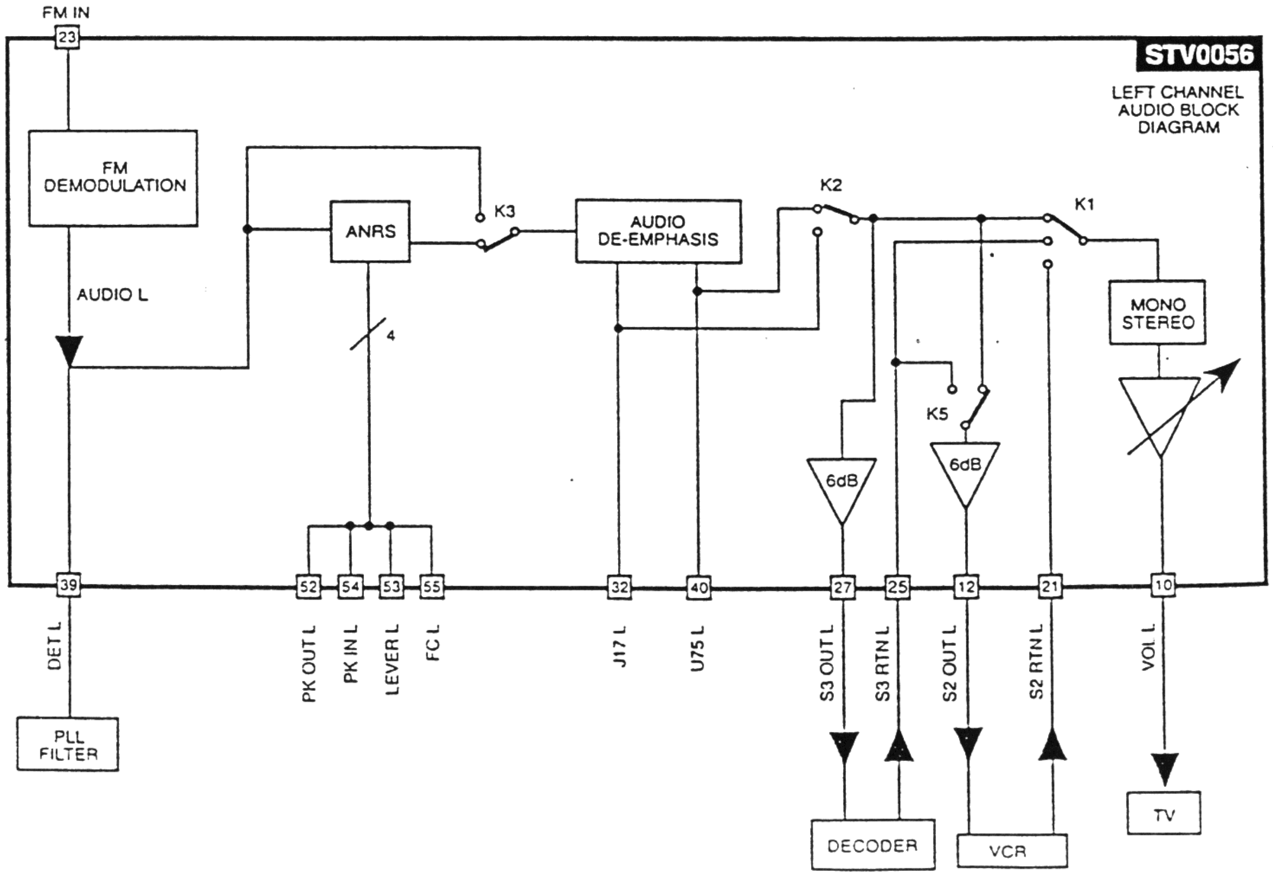
The U75L and U75R, pins 40 and 48, set the de-emphasis for 50µs and 75µs. The resistor and capacitor to Vref from these pins have a time constant of 75µs. A resistor inside U500 can be added in parallel which changes the time constant of the network to 50µs. Audio can be seen on these pins.

The J17L and J17R, pins 32 and 33, set the de-emphasis for J17. Audio can be seen on these pins.

Switch K3 (shown on the block diagram on page 14) selects between PANDA and non-PANDA de-emphasis. Panda de-emphasis is the ANRS plus 75 µs. Switch K2 selects between J17, 50 µs or 75 µs. Switch K1 selects the audio source for the TV SCART, internal satellite, external decoder or VCR. Switch K5 selects the audio source for the VCR SCART, internal decoder or external decoder. The audio source for the decoder SCART is fixed to internal.

If an external decoder is connected and pin 8 goes high the decoder audio will be switched by K5 out to the VCR SCART and by switch K1 out to the TV SCART. As can be seen, the audio output on the DECODER and VCR SCARTs is of a fixed level whereas the audio output on the TV SCART has volume control. Similarly if a VCR is connected and pin 8 goes high then the VCR audio return will be switched by K1 out to the TV SCART.


FM IN
23
STV0056
RIGHT CHANNEL
AUDIO BLOCK
DIAGRAM
FM
DEMODULATION
AUDIO R
ANRS
4
K3
AUDIO
DE-EMPHASIS
K2
K1
MONO
STEREO
K5
6dB
6dB
47
51
2
3
1
33
48
28
24
14
22
6
DET R
PK OUT R
PK IN R
LEVER R
FC R
J17 R
U75 R
S3 OUT R
S3 RTN R
S2 OUT R
S2 RTN R
VOL R
PLL
FILTER
DECODER
VCR
TV


FM IN
23
STV0056
LEFT CHANNEL
AUDIO BLOCK
DIAGRAM
FM
DEMODULATION
AUDIO L
ANRS
4
K3
AUDIO
DE-EMPHASIS
K2
K1
MONO
STEREO
K5
6dB
6dB
39
52
54
53
55
32
40
27
25
12
21
10
DET L
PK OUT L
PK IN L
LEVER L
FC L
J17 L
U75 L
S3 OUT L
S3 RTN L
S2 OUT L
S2 RTN L
VOL L
PLL
FILTER
DECODER
VCR
TV

UHF Audio Output

The audio source for the UHF output can be any of the following:

FM SAT

VCR

DEC

The signals at pins 6 and 10 of U500 are combined by R523 and R524 before being AC coupled by C200 into the modulator. C201 and R200 pre-emphasise the audio. R201 biases the audio level. The audio source for the modulator is always the same as that for the TV SCART. The signal level can be controlled by the volume rocker key on the satellite receiver handset.

TV SCART Audio Output and Phono Socket Output

Any of the following audio sources can be routed to the TV SCART:

FM SAT

VCR

DEC

The signals at pins 6 and 10 of U500 are AC coupled to the TV SCART by C527 and C528 respectively.

The signals to the TV SCART also pass to the right and left phono connectors PL601. The signal level can be controlled by the volume rocker key on the satellite receiver handset.

Decoder SCART Audio Output

The audio source for the DECODER SCART output is always FM SAT (L and R) (frequency modulated satellite signal - i.e. analogue audio). Note that the DECODER SCART is an auxiliary input and a decoder output. It can be used as an audio and video input, but only the audio from the satellite signals and selected baseband video are output, so if you were to attach a VCR to this SCART, you could record satellite audio, but you will only be able to record a good picture if the Decoder Output option at the Set Up Programme Menu is set to Clamped.

C554 (for the right channel) and C553 (for the left channel) couple the output signals from pins 28 and 27 respectively of U500 to the DECODER SCART connector. The signal level cannot be controlled by the volume rocker key on the satellite receiver handset.

VCR SCART Audio Output

The audio source for the VCR SCART output can be any one of the following:

FM SAT

DEC

C542 (for right channel) and C529 (for the left channel) couple the signals from pins 14 and 12 respectively of U500 to the VCR SCART. The signal level cannot be controlled by the volume rocker key on the satellite receiver handset.

Fault Finding

The oscillograms which follow are divided into five sections: Video, Audio, SMPS and Control. It is important that, within each of these sections, you check the presence of the signals in the order they are given (e.g. for the video circuitry test at points 1 to 13 in that order).

The oscillogram numbers are marked on the circuit diagrams and the PCB component ident diagrams. The oscillogram test points have been chosen to be on the more convenient side of the board (i.e. non-copper side of the main PCB). If possible, the other points where we suggest you make checks are also on this side of the PCB.

Alongside each oscillogram is a note of where the test point is, a brief description (including any special instructions) and notes on which components you need to check if your trace is not like that shown.

NOTE: The horizontal and vertical scales of each oscillogram are shown at the bottom. The 0 V point is shown by "1" with an arrow at the left-hand side; the trigger voltage is given at the bottom right-hand side and shown by an arrow at the extreme right of the trace. If the oscilloscope needs to be AC-coupled this fact is mentioned in the text, otherwise it is DC-coupled.

Generally, if you suspect that an IC is not functioning, before you try to replace it you should check the following:

- that it is receiving its supply at the appropriate pin (if it is not being supplied, trace back the supply line to the PSU to find the fault);
- that the IC is receiving instructions from U700 or port expanders via the control lines at the appropriate pins;
- that the receiver has been configured correctly at the appropriate menus (see the User Manual for details).

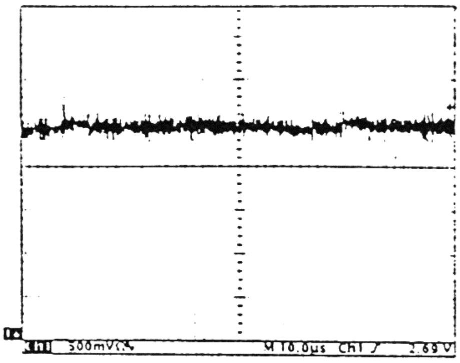
Test Point 1: Negative side of C548

Description: The trace shows tuner output (i.e. totally unfiltered video). The signal may look noisier than the trace shown if the signal is weak or the dish antenna is small.

If the trace is not as shown, check:

- that the tuning voltage on pin 15 of TUN100 changes when different programmes are selected;
- the prescaler output on pin 18 of TUN100;
- the LNB voltage on pin 5 or pin 3 of TUN100 (depending on whether the current programme is from Input 1 or Input 2 respectively). (Input 2 is only present in some models;)
- 5 V supply on pin 12 of TUN 100.

1. VIDEO MAIN PCB



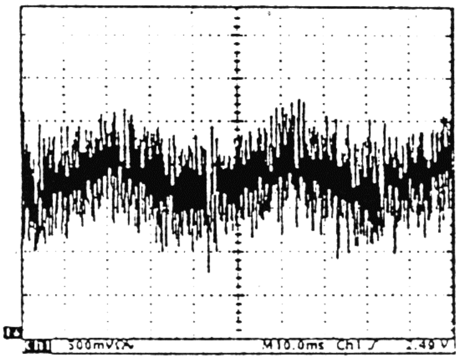
Test Point 2: Either side of L502

Description: Traces 2A and 2B show the normal video signal at test point 2, only the time axis is different; there may be slight variations in the trace, depending on picture content.

If the trace is not as shown, check:

- 12 V supplies on pins 17 and 45 of U500;
- 5 V supply on pin 36 of U500;
- clock and data are present on pins 30 and 31 of U500 when a satellite programme is selected;
- 237 kΩ resistor is fitted between pin 50 and ground;
- 4 MHz clock on pin 35 of U500.

2A. VIDEO MAIN PCB

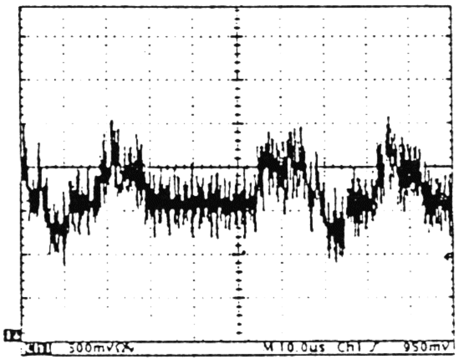


Test Point 2: Either side of L502
(see also previous Oscillogram 2A)

Note

The scope has a different setting in Oscillogram 2B.

2B. VIDEO MAIN PCB



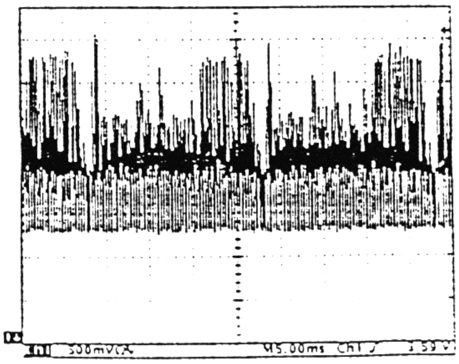
Test Point 3: R601 (same as pin 9 of U500)

Description: The trace shows clamped video at the DC level of 2.0 V (black level). This is the video signal at the main TV output of U500.

If the trace is not at the correct DC level, check:

- the signal on pin 13 of U500 looks like trace 3. If not check back to pin 15;
- that either VCR pin 8 or decoder pin 8 is not high. This would cause the video output on pin 9 to switch to the VCR or decoder input (i.e. nothing).

3. VIDEO MAIN PCB



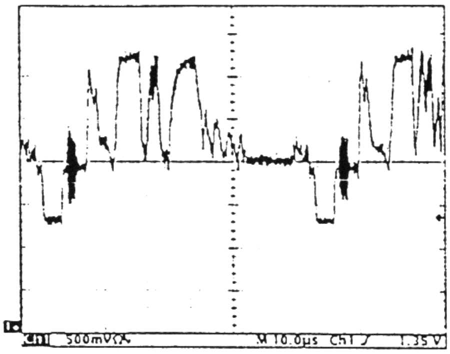
Test Point 4: R601 (same as pin 9 of U500)

Description: This trace also shows clamped video; its DC level is important - it should be approx. 2 V black level and approx. 2 V pk to pk (sync. to bar).

If the DC level is not correct, check:

- D600, Q600 and U600.

4. VIDEO MAIN PCB



Test Point 5: Pin 8 of U600

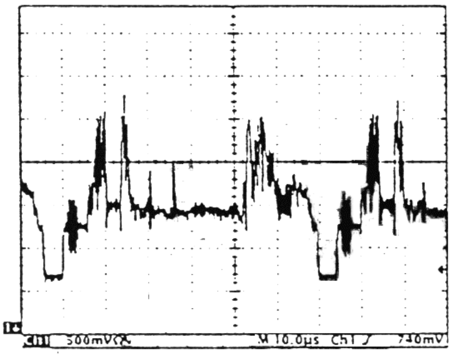
Description: Trace 5A shows the trace you would expect at test point 5 when there is a picture on the screen; trace 5B (next oscillogram) shows what to expect if there is a plain coloured background with graphics on the screen.

Check for trace 5A. If this is as expected, then select a plain coloured screen with graphics (e.g. Main Menu) and look for trace 5B.

If the trace is not as shown, check:

- that the horizontal sync is being fed into pin 18 of U600 (see oscillogram 6);
- that the vertical sync is being fed into pin 19 of U600 (see oscillogram 7).

5A. VIDEO MAIN PCB



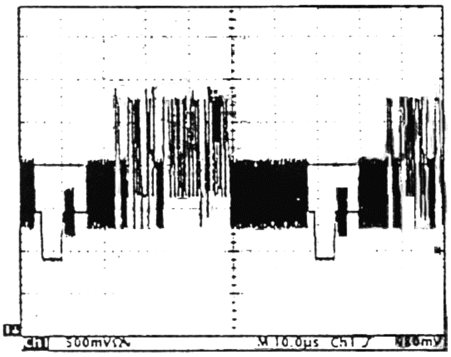
Test Point 5: Pin 8 of U600 (see oscillogram 5A)

Description: Trace 5B shows what to expect at test point 5 if there is a plain coloured background with graphics on the screen. The graphics can be seen on the centre of the trace.

If the trace is not as shown, check:

- X600 is oscillating at 17.734 MHz;
- L602 is oscillating at approximately 7 MHz.

5B. VIDEO MAIN PCB



Test Point 6: PIN 18 U600

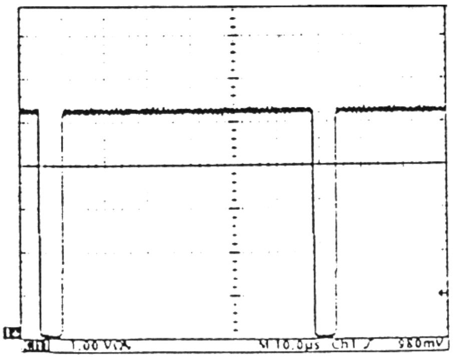
Description: The trace shows the horizontal sync. as it enters pin 18 of U600.

If the trace is not as shown, check:

- Q606, Q607, Q608, Q609 and associated components in the sync. separator circuitry.

Check that the trace shown right is also at pin 39 of U700; if it is not, check the path including J602.

6. VIDEO MAIN PCB



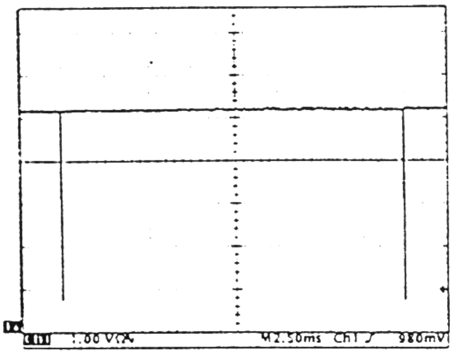
Test Point 7: LK257

Description: The trace shows the vertical sync. as it enters pin 19 of U600.

If the trace is not as shown, check:

- Q606, Q607, Q608, Q609 and associated components in the sync. separator circuitry.

7. VIDEO MAIN PCB



Test Point 8: Pin 19 of SK600 (TV SCART) (similar to pin 8 of U600)

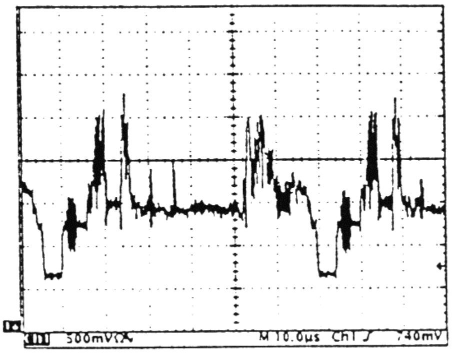
Description: Trace 8A shows the trace you would expect at test point 8 when there is a picture on the screen; trace 8B (next oscillogram) shows what to expect if there is a plain coloured background with graphics on the screen.

Check for trace 8A. If this is as expected, then select a plain coloured screen with graphics (e.g. Main Menu) and look for trace 8B.

If the trace is not as shown or has the wrong amplitude, check:

- Q601 and associated circuitry.

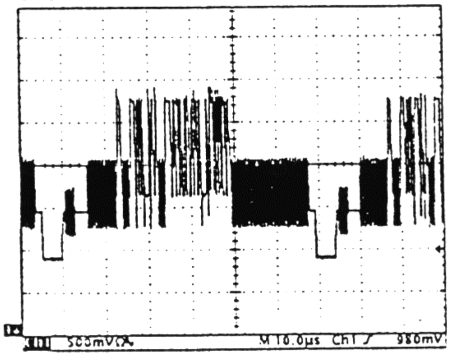
8A. VIDEO MAIN PCB



Test Point 8: Pin 19 of SK600 (TV SCART) (similar to pin 8 of U600) (see oscillogram 8A)

Description: Trace 8B shows what to expect at test point 8 if there is a plain coloured background with graphics on the screen. The graphics can be seen on the centre of the trace.

8B. VIDEO MAIN PCB



Test Point 9: Pin 19 of SK603 (DECODER SCART)

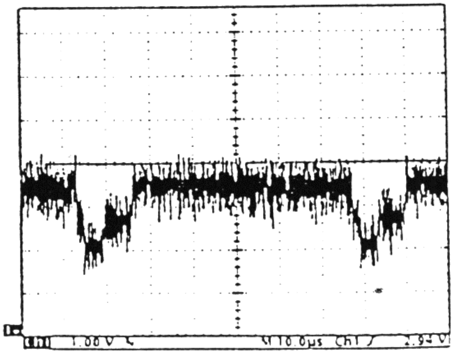
Description: For traces 9A and 9B no external decoder is attached to the DECODER SCART.

The trace 9A is when PAL has been set at the "Decoder Output" option in the Set Up Programme Menu. It shows baseband video and should be approx. 2 V pk to pk. See also Oscillogram 9B below.

If the trace is not as shown or has the wrong amplitude, check:

- U500, R533, R534, R536, C541, C545 and the route from pin 8 of U500;
- Q605 and associated components.

9A. VIDEO MAIN PCB



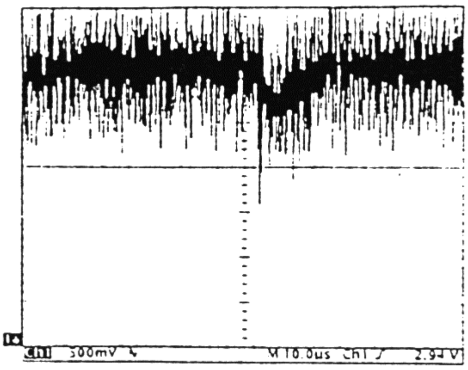
Test Point 9: Pin 19 of SK603 (DECODER SCART)

Description: The trace 9B is when "Flat" has been set at the "Decoder Output" option in the Set Up Programme Menu. It shows baseband video and should be approx. 1 V pk to pk. See also Oscillogram 9A above.

If the trace is not as shown or has the wrong amplitude, check:

- U500 and the route from pin 8 of U500.

9B. VIDEO MAIN PCB



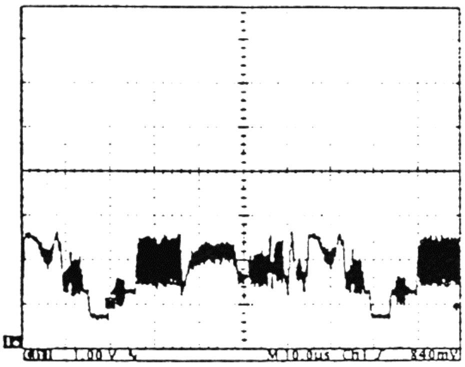
Test Point 9: Pin 19 of SK603 (DECODER SCART)

Description: The trace 9C is when "Clamped" has been set at the "Decoder Output" option in the Set Up Programme Menu. In this case, it is NOT the output from the baseband amplifier in U500 which passes to the DECODER SCART. Instead it is the clamped video signal from the energy dispersal clamp. The trace is therefore very similar to Oscillogram 8.

If the trace is not as shown, check:

- U500 and the route from pin 8 of U500.

9C. VIDEO MAIN PCB



Test Points 10: Positive sides of C527 and C528 and at LK252

Description: AC coupled oscilloscope

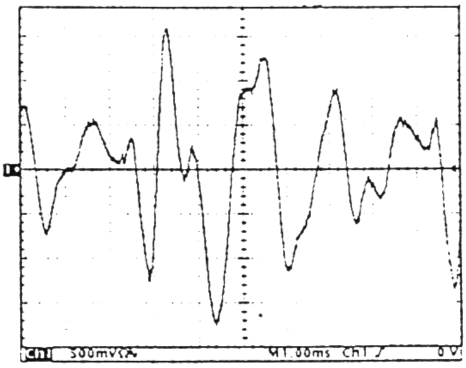
The trace should be similar at all three points. It shows the amplified audio signals for the right channel (C527) and left (C528) before they pass to the phono outputs and to the TV SCART.

The signal should be biased around 0 V, so ensure that the trace is produced with 0 V at the centre of the screen.

If the trace is not as shown, check:

- the components and circuitry back to and including U500.

10. AUDIO MAIN PCB



WARNING: While you are making the following measurement, you must NOT be earthed and the oscilloscope must NOT be earthed at its mains plug. The oscilloscope probe's earth clip must be attached to the junction of D1 and D2.
Do not touch any metal parts of the oscilloscope.

Test Point 11: Junction of pin 3 of U1 and D6

Description: AC coupled oscilloscope

The frequency of the trace varies with the input voltage and the PSU load.

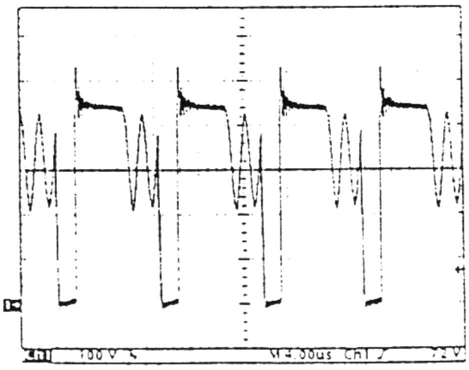
If trace is not as shown, TURN OFF THE PSU and check:

- the SMPS circuit, especially C3; if fuse FS1 keeps blowing, check for shorts on any of the supply rails.

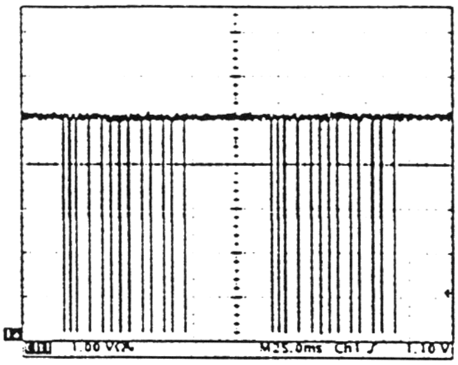
Taking heed of the WARNING above, power up the receiver again and check that:

- the voltage at pin 1 of U1 charges up to approximately 6 V then drops to approx. 5.5 V - if it does not, check FS1 or suspect U1.

11. SMPS MAIN PCB



12. CONTROL MAIN PCB



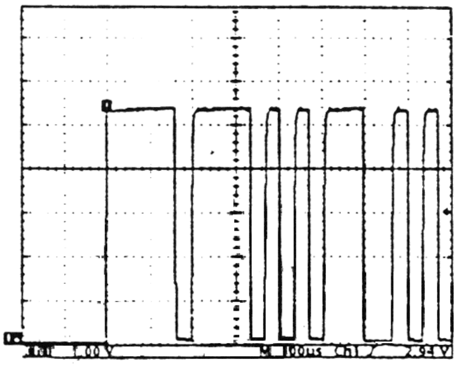
Test Point 12: LK124 (same as pin 1 of IR1)

Description: The trace shows typical data out of the IR sensor; press keys on the handset to obtain the trace.

If the trace is not as shown, check:

- the handset and IR1;
- 5 V supply to IR1.

13. CONTROL MAIN PCB



Test Point 13: Pin 31 of U500

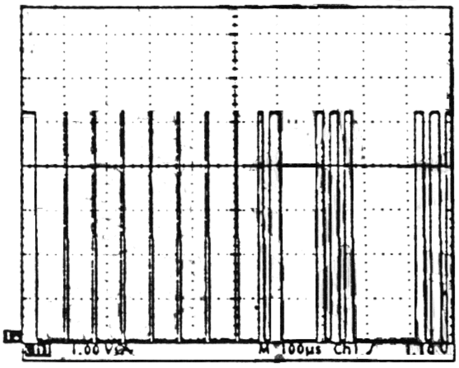
Description: The trace shows a typical data (DATA) signal when the handset keys are pressed to change the programme number.

Press the number keys while looking for the trace.

If the trace is not as shown, check:

- U700 and any of the ICs on the I²C bus or serial bus.

14. CONTROL MAIN PCB



Test Point 14: LK 255 (similar to pin 40 of U700)

Description: The trace shows a typical I²C clock (SERIAL_CLK) signal when the handset keys are pressed to change the programme number. The SERIAL_CLK line on pin 40 of U700 should be similar.

Press the number keys while looking for the trace.

If the trace is not as shown, check:

- U700 and any of the ICs on the serial bus (for SERIAL_CLK) or the I²C bus (for I2C_CLK).

Grid Refs - Ident Diagrams for the Main PCB

• = not fitted

† = mounted on copper (SMD) side of PCB

^ = actually a link (in an inductor position)

= only fitted if dual bandwidth receiver

$ = only fitted if dual LNB inputs present

NOTE. Links and zerohm resistors in the "options" circuitry are fitted, even if the receiver does not have the option.

CAPACITORS

C1	D3
C3	G2
C4	G4
C5	G4 †
C6	H6
C7	K3
C8	L3 †
C9	L3
C10	O4
C11	M3 †
C12	M2
C13	O3
C14	M4 †
C15	O4 †
C16	M4
C17	O5
C18	M5 †
C19	M5
C20	O5
C21	L7 †
C22	M8 †
C23	L8 †
C24	G15 †
C25	G15
C26	H15 †
C27	H15
C28	K9 †
C29	J10
C30	O7
C31	N7
C32	M7 †
C33	G9
C34	I9 †
C35	K7 †
C36	K10
C37	P2 †
C38	H2
C39	G5 †
C40	F2
C41	E7 †
C42	P17 †
C100	F27
C102	I25 †
C103	H26 †
C104	H26 †
C105	H23
C106	E23 †
C107	F23 †
C108	G25 †
C109	H24
C110	H23 †
C111	G24 †
C112	E22 †
C113	F22 †
C114	G23
C116	D23 †
C117	B22 †
C118	B22
C119	C23 †
C120	B21
C121	I25 †
C200	E24
C201	E24 †
C202	E24 †
C203	F24 †
C204	F25 †
C205	F25 †
C206	F26 †
C207	F26 †
C208	F26 †
C209	E26 †
C210	E26 †
C211	D24 †
C212	D24 †
C213	H27 †
C215	D25 †
C216	D25 †
C217	D25 †
C218	C26 †
C219	E26 †
C220	D26
C221	D26 †
C222	C26 †
C223	C26 †
C224	B26 †
C225	C24 †
C226	B24 †
C227	B25 †
C228	F25 †
C229	F26 †
C230	D24 †
C231	C24 †
C232	E26 †
C300	J19 †
C301	J20 †
C302	J19 †
C303	J19 †
C304	K20 †
C305	I17 †
C306	L19 †
C307	K21
C308	K18 †
C309	K20 †
C310	K20 †
C311	K19 †
C312	K20 †
C313	K19 †
C314	J18 †
C315	J18 †
C316	J17 †
C317	J16 †
C318	J17 †
C319	I16 †
C320	H16 †
C321	H16 †
C322	G16 †
C323	J11
C324	N10 †
C325	O7
C326	J11
C327	I13 †
C328	N10 †
C329	N8
C330	K16 †
C331	L14 †
C332	N8 †
C333	N9 †
C334	N9 †
C335	M10 †
C336	M9
C337	M9 †
C338	M10 †
C339	M9
C340	K11 †
C341	M10
C342	K11 †
C343	O8 †
C344	P8 †
C345	M20 †
C346	M19 †
C347	M18 †
C348	O19 †
C349	J22 †
C350	L21
C351	J21 †
C352	K24 †
C353	N25 †
C354	L24 †
C355	K13 †
C356	I24 †
C357	I23 †
C358	I24 †
C359	M17 †
C360	M18 †
C361	M18 †
C362	K18 †
C363	J20 †
C364	K19 †
C365	M19 †
C368	O18 †
C369	N14 †
C370	K14 †
C500	H21 †
C501	H20 †
C502	H20 †
C503	G20 †
C504	H21
C505	H20 †
C506	H20
C507	H19 †
C508	H19 †
C509	G19 †
C510	G19 †
C511	G19 †
C512	H19
C513	G19 †
C514	H19 †
C515	H18 †
C516	G18 †
C517	H18
C518	H18 †
C520	H16 †
C521	G16 †
C522	G18 †
C523	F16 †
C524	F17 †
C526	F18 †
C527	C13
C528	C13
C529	C8
C530	F19 †
C531	E19 †
C532	E18 †
C534	D19 †
C535	D19 †
C536	D19 †
C537	D19 †
C538	D19 †
C539	E19 †
C540	E19 †
C541	G19 †
C542	C9
C543	D18 †
C544	G20 †
C545	E19
C546	C7
C547	C8
C548	G22
C549	G21 †
C550	C19
C551	C20
C552	G21 †
C553	C20
C554	B20
C555	G22 †
C556	G20 †
C557	G16 †
C558	H16 †
C559	G17 †
C560	F16 †
C561	E16 †
C562	F16 †
C563	E20 †
C564	E19 †
C600	G12
C601	G13
C602	G12 †
C603	H12 †
C604	G12
C605	E13 †
C606	E13 †
C607	F14 †
C608	E14
C609	F13 †
C610	F13 †
C611	C15
C612	C16 †
C613	C7 †
C614	C12 †
C615	E15 †
C616	E14 †
C617	E15 †
C618	F15 †
C619	B9 †
C620	B9 †
C621	C8 †
C622	C7 †
C623	C19 †
C624	B19 †
C625	C19 †
C626	B20 †
C627	B14 †
C628	B15 †
C629	B13 †
C630	C13 †
C631	B13 †
C632	C12 †
C700	P4 †
C701	P3
C702	F9 †
C703	F10 †
C704	F10 †
C705	F11 †
C706	E7 †
C707	E8 †
C708	E7 †
C709	Q8 †
C710	P7
C711	C9

DIODES

D1	E4
D2	F5
D3	F5
D4	F5
D5	K2
D6	H5
D7	G4
D8	G4
D9	L2
D10	L2
D11	L4
D12	L5
D13	P6
D14	I8
D15	H8
D16	L7
D17	N7
D18	I10
D19	K4
D20	H4
D21	K5
D200	F25 †
D300	N10
D301	N9
D302	N10
D303	N10
D304	N10
D306	J25
D307	J25
D308	J25
D309	J25
D310	J26
D311	J26
D312	J26
D313	J26
D400	K22
D401	K21
D500	G17
D501	H17
D503	H19
D504	I19
D600	G11
D601	C12
D602	C16
D603	C16
D604	C10
D605	C6
D606	C10
D607	E8

INDUCTORS

L1	C3
L2	C2
L3	N3
L4	N3
L6	N4
L8	N5
LK8	L6
L9	H23
L10	I15
L11	I15
L12	H3
L13	G5
L100	F22
L102	G25
L200	F24
L201	E25
L202	D24
L203	F25
L204	B25
L205	F24
L300	J19
L301	J20
L302	H16
L303	L11
L304	M19
L305	M19
L306	M19
L307	J20
L308	I25
L500	E18
L501	D19
L502	D19
L503	G21
L504	E20
L601	H12
L602	G13

LINKS

J101	E21
J102	E21
J200	F24
J300	O17
J301	O17
J302	O16
J303	O16
J600	C14
J601	C14
J602	E10
LK100	P4
LK101	P6
LK102	P8
LK103	P7
LK104	O6
LK105	O7
LK106	N6
LK107	O8
LK108	N9
LK109	M7
LK110	L7
LK111	L9
LK112	K8
LK113	K9
LK114	L10
LK115	J8
LK116	J8
LK117	J8
LK118	J8
LK119	I8
LK120	I7
LK121	P12
LK122	P12
LK123	P12
LK124	P13
LK125	O11
LK126	O11
LK127	O12
LK128	O12
LK129	O12
LK130	O12
LK131	O12
LK132	O13
LK133	O13
LK134	P13
LK135	O12
LK136	N12
LK137	N12
LK138	N12
LK139	O13
LK140	O13
LK141	N13
LK142	O14
LK143	P14
LK144	P15
LK145	P15
LK146	O14
LK147	O15
LK148	O15
LK149	O15
LK150	O15
LK151	N15
LK152	N15
LK153	O16
LK154	P16
LK155	O16
LK156	O16
LK157	N16
LK158	N16
LK159	N16
LK160	M16
LK161	M16
LK162	M16
LK163	M16
LK164	L16
LK165	L16
LK166	K16
LK167	K16
LK168	K16
LK169	K16
LK170	L17
LK171	L17
LK172	L17
LK173	L17
LK174	M17
LK175	M17
LK176	M17
LK177	M17
LK178	N17
LK179	P17
LK180	P19
LK181	P20
LK182	M20
LK183	M20
LK184	M20
LK185	M21
LK186	M21
LK187	M21
LK188	M21
LK189	M21
LK190	M22
LK191	N21
LK192	N22
LK193	O22
LK194	O23
LK195	O23
LK196	O23
LK197	P24
LK198	O24
LK199	O24
LK200	O24
LK201	O24
LK202	M21
LK203	K21
LK204	K21
LK205	J14
LK206	J14
LK207	J14
LK208	J14
LK209	J15
LK210	I13
LK211	J15
LK212	J16
LK213	I17
LK214	J19
LK215	J20
LK216	J23
LK217	I26
LK218	I8
LK219	H8
LK220	H8
LK221	H8
LK222	I9
LK223	I10
LK224	I10
LK225	I11
LK226	I11
LK227	H9
LK228	H11
LK229	H11
LK230	H11
LK231	F12
LK232	D6
LK233	D8
LK234	E9
LK235	E9
LK236	C9
LK237	D10
LK238	D10
LK239	D10
LK240	D11
LK241	E11
LK242	E12
LK243	E12
LK244	E12
LK245	D11
LK246	D11
LK247	D12
LK248	D12
LK249	D12
LK250	D13
LK251	D13
LK252	D13
LK253	I12
LK254	I13
LK255	H13
LK256	H13
LK257	H14
LK258	H14
LK259	I14
LK260	H14
LK261	I15
LK262	H14
LK263	G14
LK264	G14
LK265	F14
LK266	G16
LK267	D15
LK268	E16
LK269	E16
LK270	E17
LK271	E17
LK272	D17
LK273	D16
LK274	D16
LK275	D17
LK276	D17
LK277	C18
LK278	C18
LK279	H18
LK280	H21
LK281	H22
LK282	I22
LK283	H22
LK284	H22
LK285	G22
LK286	H23
LK287	H23
LK288	F20
LK289	E21
LK290	I24
LK291	I25
LK292	G25
LK293	G23
LK294	G25
LK295	F23
LK296	E23
LK297	D20
LK298	D20
LK299	D20
LK300	C21
LK301	D23
LK302	D23
LK303	D24
LK304	C24
LK305	C26
LK306	C26
LK307	M3
LK308	N15

TRANSISTORS

Q1	P2
Q2	K7
Q3	J7 †
Q4	G8 †
Q5	J9 †
Q6	J10 †
Q7	K8 †
Q8	K8 †
Q9	O8 †
Q100	H24 †
Q101	G22 †
Q102	E21
Q103	D21
Q104	D21 †
Q105	D21 †
Q106	C22 †
Q107	D22 †
Q200	F25 †
Q300	J18 †
Q301	K20 †
Q302	J18 †
Q303	J17 †
Q304	J17 †
Q305	J16 †
Q306	J16 †
Q307	J16 †
Q308	J16 †
Q309	J15 †
Q310	G16 †
Q311	N10 †
Q312	L14 †
Q313	P10 †
Q314	L23 †
Q315	L22
Q500	E18 †
Q501	E18 †
Q502	D18 †
Q503	G17 †
Q504	F16 †
Q600	D6 †
Q601	D10 †
Q602	C16 †
Q603	C10 †

Q604	C12 †	R107	H24 †	R319	J17 †	R391	N21 †	R541	H21 †	R636	E15 †	R833	O20 †	R889	J21 †	U306	J24
Q605	C17	R108	E23 †	R320	J17 †	R392	N21 †	R544	G18 †	R637	F15 †	R834	N19 †	R890	J21 †	U500	G19
Q606	E15 †	R110	E22 †	R321	J16 †	R400	K22 †	R545	G20 †	R638	F15 †	R835	O19 †	R891	J22 †	U600	F13
Q607	E15 †	R111	F22 †	R322	J16 †	R401	L22 †	R546	G16 †	R639	F14 †	R836	N20 †	R892	J23 †	U700	F9
Q608	F15 †	R112	D23 †	R323	J15 †	R402	L22 †	R547	H17 †	R640	F15 †	R837	N20 †	R893	J24 †	U701	E7
Q609	F15 †	R113	B23 †	R324	J14 †	R404	J22 †	R548	H16 †	R641	E15 †	R838	O20 †	R894	F7 †	U703	J7
Q610	E8 †	R114	C23 †	R325	J15 †	R408	K26 †	R549	F16 †	R642	F15 †	R839	O20 †	R895	F6 †	U709	Q10
Q700	H10 †	R115	E22	R326	J15 †	R409	J26 †	R550	G17 †	R643	C9 †	R840	O20 †	R896	F7 †	U710	Q11
RESISTORS		R116	E22	R327	J15 †	R410	N24 †	R551	E16 †	R644	C7 †	R841	N17 †	R897	G8 †	**MISC.**	
R1	D4	R117	E21	R328	J15 †	R411	J26 †	R552	H22 †	R645	C9 †	R842	M17 †	R898	F8 †	**COMPONENTS**	
R2	F4 †	R118	E22	R329	J16 †	R412	K25 †	R553	D15 †	R646	E8 †	R843	M18 †	R899	F8 †	CRD300	L13
R3	H5 †	R119	C21 †	R332	I16	R413	K25 †	R554	D16 †	R647	F7	R844	N19 †	R900	D9 †	CRD301	M24
R4	H3 †	R120	C21 †	R333	G16 †	R414	K26 †	R555	D6 †	R648	H7	R845	M19 †	R901	D9 †	CRD302	L24
R5	F2 †	R121	C21 †	R336	N10 †	R415	K26 †	R556	D7 †	R700	P11 †	R846	P21 †	R902	D10 †	CRD303	L24
R6	C3 †	R122	C21 †	R339	N10 †	R418	K24 †	R557	C7 †	R701	P11 †	R847	P24 †	R903	C13 †	FC1	C4
R7	C2 †	R123	C22 †	R340	K16 †	R500	H21 †	R558	C9 †	R702	P5	R848	O25 †	R904	H14 †	FC2	D4
R9	O3 †	R124	C21 †	R341	L14 †	R501	H21 †	R559	C19 †	R703	F8 †	R849	O25 †	R905	H15 †	FC3	L6
R10	P2	R125	C22 †	R342	N8 †	R502	H20 †	R560	C20 †	R704	F8 †	R850	O24 †	R906	H16 †	FC4	K6
R11	P4	R126	E22 †	R343	N11 †	R503	H20 †	R561	C20 †	R705	F8 †	R851	N23 †	R907	G15 †	HS1	K7
R12	J9 †	R127	D22 †	R344	M9 †	R504	H22 †	R562	C20 †	R706	H11 †	R852	L25 †	R908	G16 †	HS2	K10
R13	J9 †	R200	E24 †	R345	N9 †	R505	H20 †	R600	D6 †	R707	H10 †	R853	M24 †	R909	H17 †	IR1	Q10
R14	J9 †	R201	E24 †	R346	M8 †	R506	H19 †	R601	E14	R708	E7 †	R854	L24 †	R910	H17 †	IR700	Q3
R15	K7 †	R202	F24 †	R347	L11 †	R507	H19 †	R602	C9 †	R709	E9 †	R855	M25 †	R911	H18 †	LED2	P9
R16	K7	R203	F25 †	R348	M9 †	R508	G19 †	R603	G12 †	R800	N3 †	R856	L25 †	R912	F17 †	LED700	P18
R17	J7 †	R204	F25 †	R349	M10 †	R509	G18 †	R604	G12 †	R801	Q7 †	R857	L24 †	R913	H19 †	LED701	P16
R18	L7 †	R205	F26 †	R350	L10 †	R510	H18 †	R605	F14 †	R802	P8 †	R858	K26 †	R914	H20 †	LED702	P11
R19	L7 †	R206	F26 †	R351	L11 †	R511	H18 †	R606	E13 †	R803	O9 †	R859	L24 †	R915	H20 †	MOD1	D25
R21	G7 †	R207	F26 †	R352	L10 †	R512	G18 †	R607	C16 †	R804	O9 †	R860	J22 †	R916	G19 †	S701	E7
R22	G8 †	R208	E26 †	R354	I13 †	R513	H18 †	R608	C10 †	R805	P11 †	R861	K22 †	R917	H23 †	S702	E8
R23	F8 †	R210	D26 †	R356	N19 †	R514	H17 †	R609	C10 †	R806	P11 †	R862	K22 †	R918	G24 †	S703	E8
R24	L8 †	R211	D25 †	R357	F9 †	R515	H18 †	R610	C12 †	R807	P12 †	R863	L22 †	R919	G23 †	S704	E8
R25	L8 †	R212	C25 †	R360	P9 †	R516	H17 †	R611	B10 †	R808	O11 †	R864	J22 †	R920	G25 †	S705	E8
R26	M8 †	R213	D25 †	R361	P9 †	R517	H16 †	R612	D11	R809	O11 †	R865	K22 †	R921	C25 †	SW700	P7
R27	G9 †	R214	D24 †	R362	P15 †	R518	G16 †	R613	E11	R810	P13 †	R866	K22 †	R923	C15 †	SW701	P6
R28	K8 †	R215	D24 †	R363	P14 †	R519	F16 †	R614	C14 †	R811	O15 †	R867	J23 †	R924	G2 †	SW702	P4
R29	K8 †	R217	C25 †	R364	P14 †	R520	G17 †	R615	C14 †	R812	O16 †	R868	K23 †	R925	G2 †	SW703	P15
R30	K8 †	R219	B24 †	R365	P14 †	R521	F16 †	R616	C14 †	R813	M7 †	R869	K23 †	R926	O26 †	SW704	P19
R31	J9 †	R220	B26 †	R366	P14 †	R522	F16 †	R617	C16 †	R814	M8 †	R870	M23 †	**CONNECTORS**		SW705	P18
R32	M8 †	R221	F25 †	R367	O14 †	R523	F18 †	R618	C17 †	R815	L12 †	R871	K23 †	SK1	B3	SW706	P17
R33	M8	R300	J18 †	R368	O13 †	R524	F18 †	R619	C17 †	R816	L12 †	R872	K23 †	SK600	B12	SW707	P20
R34	M8 †	R301	J20 †	R369	M13 †	R525	E18 †	R620	C18 †	R817	M13 †	R873	L23 †	SK601	B7	SW708	P21
R35	M8 †	R302	J19 †	R370	P10 †	R526	E18 †	R621	C18 †	R818	N14 †	R874	M23 †	PL601	B15	T1	E2
R36	N7 †	R303	J19 †	R371	P10 †	R527	E18 †	R622	C6 †	R819	K15 †	R875	K23 †	SK603	B18	T2	I4
R37	N7 †	R304	K20 †	R372	P9 †	R528	E18 †	R623	C6 †	R820	K11 †	R876	K23 †	**ICS**		T3	I4
R38	N8 †	R305	K20 †	R373	P9 †	R529	E19 †	R624	C11 †	R821	J11 †	R877	L23 †	U1	G5	TST100	G22
R39	P9 †	R306	K19 †	R374	M19 †	R530	D18 †	R625	C11 †	R822	J11 †	R878	M23 †	U2	M7	TST300	P9
R40	J7 †	R307	N18 †	R375	M19 †	R531	D18 †	R626	C6 †	R823	I12 †	R879	L23 †	U3	K9	TUN100	D22
R41	I9 †	R308	N18 †	R377	L17 †	R532	E19 †	R627	C6 †	R824	I12 †	R880	M23 †	U100	H25	VDR1	E4
R42	I9 †	R309	K19 †	R378	M17 †	R533	G20 †	R628	C12 †	R825	I13 †	R881	L24 †	U200	E25 †	X100	I26
R43	L8 †	R310	L14 †	R379	M18 †	R534	G20 †	R629	C12 †	R826	P17 †	R882	M24 †	U201	C25 †	X300	M19
R44	G4 †	R312	J18 †	R380	M18 †	R535	E16 †	R630	C17 †	R827	P15 †	R883	J24 †	U300	L19	X301	N9
R100	G26 †	R313	J18 †	R382	N19 †	R536	F19 †	R631	C17 †	R828	P19 †	R884	K24 †	U301	J12	X600	E13
R101	E23 †	R314	J18 †	R387	O18 †	R537	G20 †	R632	D17	R829	O18 †	R885	K18 †	U302	M10	X700	G10
R104	G25 †	R315	J17 †	R388	N20 †	R538	G21 †	R633	E15 †	R830	N19 †	R886	L19 †	U303	P9		
R105	H24 †	R317	J17 †	R389	N20 †	R539	G21 †	R634	E14 †	R831	O19 †	R887	L20 †	U304	O19		
R106	H24 †	R318	I17 †	F390	N20 †	R540	H20 †	R635	E14 †	R832	O20 †	R888	J18 †	U305	J21		

Grid Refs - Main Circuit

INTERCONNECTIONS

-12V45	A3. A3. B3	CE_LM7001	A5. B5	H/V	A3. A5	TUNING_VOLTS	B6. B6
+12V17	A3. A4	DATA	A3. B5. B5. B6. C1	LEDH1	A5. A6	TV_PIN_8	B5. C6
4MHZ_REF	A3. A6. B2. B6			LEDH2	A5. A6	TV_PIN_10	A5. C6
12C_CLK	A3. A5. B1. B6	DEC_IN_L	A4.D6	LNB_MON	A3. A5	TV_PIN_12	A5. C6
12V_SW	A5. D6	DEC_IN_R	A4. D6	LNB_ON/OFF	A3. A5	TV_PIN_16	B5. C6
22KHZ	A3. A3	DEC_OUT_L	A4. D6	LNB_SELECT	A5. A6	VCR_IN_R	A4. D6
AFC	A5. B6	DEC_OUT_R	A4. D6	LNBSPLY	A3. A6	VCR_IN_L	A4. D6
AUDIO_L	B4. D6	DEC_PIN_8	A5. D6	R	C6. D6	VCR_OUT_R	A4. D6
AUDIO_MOD	B4. C2	DEC_PIN_16	C6. D6	$\overline{\text{RST}}$	A5. B2	VCR_OUT _L	A4. D6
AUDIO_R	B4. D6	DEC_VID_IN	B4. D6	SERIAL_CLK	A5. B5	VCR_PIN_8	A5. D6
B	C6. D6	DEC_VID_OUT	B4. D6	SK601_20	C6. D6	VCR_VID_IN	B4. D6
BANDWIDTH	A6. C1	G	C6. D6	SK603_12	C6. D6	VCR_VID_OUT	B5. D6
CE_GRAPHICS	A5. B5. C1	GRAPHICS_OUT	B6. C6	TUNER_FS	B6. B6		

➡

Grid Refs - Main Circuit

• = not fitted
^ = actually a link (in an inductor position)
# = only fitted if dual bandwidth receiver
$ = only fitted if dual LNB inputs present
@ = only fitted if VCR SCART present
~ = only fitted if DECODER SCART present

NOTE: Links and zerohm resistors in the "options" circuitry are fitted, even if the receiver does not have the option.

CAPACITORS	
C1	A1
C2	A1
C3	A1
C4	A2
C5	A1
C7	A2
C8	A2
C9	A2
C10	A2
C11	A2
C12	A2
C13	A2
C15	A2
C16	A2
C17	A2
C18	A2
C19	A2
C20	A2
C21	A3
C22	A3
C23	A3
C24	A2
C25	A2
C26	A2
C27	A2
C28	A2
C29	A2
C30	B3
C31	B3
C32	B3
C33	A5
C34	A3
C35	A3
C36	A2
C37	A2
C38	A2
C39	A2
C40•	A1
C41	A5
C42	A6
C100	B3
C102	B5
C103	B5
C104	B6
C105	C6
C106	B6
C107	B6
C108•	B6
C109	B6
C110	B6
C111	C6
C112	A5
C113	A5
C114	A5
C118$	A6
C119$	A6
C120$	A6
C121	B6
C200	C2
C201	C2
C202	C2
C203	B2
C204	B2
C205	B2
C206	B2
C207	B2
C208	B2
C209	B2
C210	B2
C211	C2
C212	B2
C213	B2
C215	B2
C216	B1
C217	B2
C218	B2
C219	B2
C220	B2
C221	C2
C222	C1
C223	C1
C224	C1
C225	B1
C227	B1
C228	B3
C229	B3
C230	C2
C231	B2
C232	C2
C319	C5
C320	C5
C321	C5
C322	C5
C500	A3
C501	A3
C502	A4
C503	A3
C504	A3
C505	A3
C506	A4
C507	A3
C508	A3
C509	A3
C510	A4
C511	A4
C512	A3
C513	B3
C514	B3
C515	B3
C516	B3
C517	B4
C518	B3
C520	B4
C521	B4
C522	B3
C523	B4
C524	B4
C526	B4
C527	B4
C528	B4
C529@	A4
C530	A4
C531	A5
C532	B5
C534	B5
C535	A5
C536	A5
C537	A5
C538	A4
C539	A4
C540	A4
C541	A4
C542@	A4
C543	A5
C544	A4
C545	A4
C546@	A4
C548	A4
C549	A4
C550~	A4
C551~	A4
C552	A4
C553~	A4
C554~	A4
C555	A4
C556	A4
C557	B4
C559	B3
C561	B4
C562	B4
C563	A4
C564	A4
C600	B5
C601	B5
C602	B5
C603	B5
C604	B5
C605	B5
C606	B5
C607	B5
C608	B5
C609	B5
C610	B5
C612~	D6
C613@	D6
C614	C6
C615	D5
C616	D5
C617-	D5
C619@	D6
C620@	D6
C621@	D6
C622@	D6
C623~	A4
C624~	A4
C625~	A4
C626~	A4
C627	C6
C628	C6
C629	C6
C630	C6
C631	C6
C632	C6
C650	B4
C700•	A6
C701•	A6
C702	A5
C703	A5
C704	A5
C705	A5
C706	A5
C707	A5
C708	A4
C709	A6
C710	A6
C711	B6
DIODES	
D1	A1
D2	A1
D3	A1
D4	A1
D5	A2
D6	A2
D7	A1
D8	A2
D9	A2
D10	A2
D11•	A2
D12•	A2
D13	A2
D14	A3
D15	A3
D16	A3
D17	B3
D18	A2
D19	A2
D20	A2
D21	A2
D200	B2
D500	B4
D501	B3
D503	A3
D504	A3
D600	B5
D601	C6
D602~	D6
D603~	D6
D604	C6
D605@	D6
D606	C6
D607~	D6
INDUCTORS	
L2•	A1
L3	A2
L4	A2
L6	A2
L8	A2
L9	C6
L10	A2
L11	A2
L12	A2
L13	A2
L100	A5
L102	B3
L200	B2
L201	B2
L202	C2
L203	B3
L204	C1
L205	C2
L284	A3
L292	B6
L302	C5
L500•	A5
L501	A5
L502	A4
L503	A4
L504	A4
L601	B5
L602	B5
J101	A6
J102	A6
J200	C2
J600	C6
J601	C6
LINKS	
LK8•	A2
LK100	A6
LK101	A2
LK105	B3
LK106	A2
LK109	A3
LK110	B3
LK112	B3
LK115	A2
LK116	A3
LK117	A2
LK118	A3
LK119	B3
LK121	A6
LK122	A6
LK124	A5
LK127	A6
LK128	A6
LK129	A6
LK130	A6
LK131	A6
LK132	A5
LK180	A5
LK181	A6
LK207	A2
LK210	A2
LK211	A2
LK212	A6
LK213	A6
LK219	A3
LK220	A2
LK221	A5
LK222	A3
LK227	A5
LK229	A2
LK230	B5
LK231	B5
LK232	A4
LK233~	D6
LK234	A5
LK236	C6
LK237	B6
LK238	C6
LK239	C6
LK240	C6
LK241	B5
LK242	B5
LK243	C6
LK244	C6
LK245	C6
LK246	B5
LK247	C6
LK248	C6
LK249	C6
LK250~	D6
LK251	B4
LK252	B4
LK253	B5
LK253	B5
LK255	B6
LK257	B5
LK258	B5
LK261	B5
LK265-	D5
LK266	A3
LK267	B4
LK268	B4
LK269	D6
LK270	B4
LK271	A5
LK272	A5
LK273	C6
LK274	D6
LK275	B4
LK276	A2
LK277~	D6
LK278	B3
LK279	A4
LK280	A5
LK281	A6
LK282	A6
LK283	A6
LK285	B3
LK286	C6
LK287	B6
LK288	A4
LK289	A6
LK290	B3
LK291	A5
LK293	B6
LK294	B6
LK295	A5
LK296	B6
LK297	A5
LK298$	A6
LK300	A6
LK302	A6
LK303•	C2
LK304	B2
LK305	B3
LK306	C1
LK307	A2
CONNECTORS	
SK1	A1
TRANSISTORS	
Q1	A2
Q2	A3
Q3	A3
Q4	A3
Q5	A3
Q6	A2
Q7	A3
Q8	A3
Q9	B3
Q100	B6
Q101	A5
Q102$	A6
Q103$	A6
Q104$	A6
Q105$	A6
Q106$	A6
Q107$	A6
Q200	B2
Q310	C5
Q500	B4
Q501	B5
Q502	A5
Q503	B3
Q504	B4
Q600@	B5
Q601	B5
Q602	C6
Q603	C6
Q604	C6
Q605~	B4
Q606~	D5
Q607~	D5
Q610~	D6
Q700	A5
RESISTORS	
R2	A1
R3	A2
R4•	A2
R5	A1
R6	A1
R7	A1
R9	A2
R10	A2
R11	A2
R12	A2
R13	A3
R14	A3
R15	A3
R16	A3
R17	A3
R18	A3
R19	A3
R21	A3
R22	A3
R23	A3
R24	A3
R25	A3
R26	A3
R27	A3
R28	A3
R29	A3
R30	A3
R31	A3
R32	A3
R33	B3
R34	B3
R35	B3
R36	B3
R37	B3
R38	B3
R39	B3
R40•	A3
R41•	A3
R42	A3
R43	A3
R44	A1
R100	B6
R101	B6
R104	B6
R105	B6
R106	C6
R107	C6
R108	B6
R110	B6
R111	A5
R112#	A6
R113$	B6
R114$	B6
R115$	A6
R116$	A6
R116$	A6
R117$	A6
R117$	B6
R118$	A6
R119$	A6
R120$	A6
R121$	A6
R122$	A6
R123$	A6
R124$	A6
R125$	A6
R126$	A6
R127$	A6
R200	C2
R201	C2
R202	B2
R203	B2
R204	B2
R205	B2
R206	B2
R207	B2
R208	B2
R210	B2
R211	B2
R212	C1
R213	B2
R214	C1
R215	C2
R217	B2
R219	B1
R220	C1
R221	B3
R256	B5
R332	C5
R333	B5
R500	A3
R501	A3
R502	A3
R503	A3
R504	A3
R505	A3
R506	A3
R507	A3
R508	A3
R509	B3
R510	A3
R511	B3
R512	B4
R513	B3
R514	B3
R515	B3
R516	B4
R517	B4
R518	B3
R520	B4
R521	B4
R522	B4
R523	B4
R524	B4
R525	B4
R527	A5
R528	B5
R529•	A5
R530	A5
R531	A5
R532	A4
R533	A4
R534	A4
R535	B4
R536	A4
R537	A4
R538	A4
R539	A4
R540•	A4
R541	A4
R544•	B3
R545•	A4
R546	B3
R547	B3
R548	B3
R549	B4
R550	B4
R551	B4
R552	B1
R553	B4
R554	B4
R555@	A4
R556@	A4
R557@	A4
R558@	A4
R559~	A4
R560~	A4
R561~	A4
R562~	A4
R600@	B5
R601	B5
R602	B5
R603	B5
R604	B5
R605	B5
R606	B5
R607	C6
R608	C6
R609	C6
R610	C6
R611	C6
R612	C6
R613	C6
R614•	D6
R615•	D6
R616•	C6
R617~	D6
R618~	D6
R619~	D6
R620~	D6
R621~	D6
R622@	D6
R623@	D6
R624	C6
R625	C6
R626@	D6
R627@	D6
R628	C6
R629	C6
R630~	B4
R631~	B4
R632~	B4
R633	D5
R634	D5
R635-	D5
R636-	D5
R638-	D5
R643	C6
R644	C6
R645	C6
R646~	D6
R647~	D6
R648~	D6
R700	A6
R701	A6
R702	A6
R703	A6
R704	A6
R705	A6
R706	A5
R707	A5
R708	A5
R709	A5
R709	A5
R800	B1
R801	A6
R806	A6
R807	A6
R813	A3
R819	A2
R824	B5
R826	A6
R828	A5
R846	A6
R847	A5
R894	A3
R895	A3
R897	A6
R898	A6
R898	A6
R899	A6
R900~	D6
R901	C6
R902	B5
R903	C6
R904	A2
R905	A2
R906	A2
R907	C5
R908	B4
R910	B4
R911	B4
R912	B4
R913	A3
R914	A3
R915	A3
R916	A4
R917	C6
R918	C6
R919	C2
R920	B1
R921	C1
R923	B3
R924	A1
R925	A1
R926	B1
ICS	
U1	A2
U2A	A3
U2B	B3
U100	B6
U200	C2
U201	C1
U500	B4
U600	B5
U700	A5
U701	A4
MISC. COMPONENTS	
FS1	A1
FS2	A2
HS1	A3
HS2	A2
IR700	A6
LED700	A6
LED701	A6
MT1	B1
MT2	B1
SW700	A6
SW701	A6
SW702	A6
T1	A1
T2	A2
TST100•	A5
TUN100	B6
VDR1	A1
X100	B6
X600	B5
X700	A5

Spares - Electrical Parts List (Main Board)

NOTE: △ indicates a safety-critical component; these must only be replaced by components of the correct type as listed in these parts lists.

Capacitors

C1	△100NF 275V 20% CLASS X2 CAP L	159-1048780
C3	47UF 400V 20% 10MM RD/EL CAP 22X25 L	155-4769783
C4	100UF 25V 20% 5MM RD/EL CAP 7X11 T	855-1072751
C5	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C6	△ 2N2F 250V 20% CLASS Y1 CAP TR	159-2228781
C7	1N0F 2KV 10% 7.5MM CER CAP (HR) TR	159-1029651
C8	SMD 47NF 50V 10% CER CAP X7R 0805 TR	950-4735621
C9	100UF 50V 20% 5MM RD/EL CAP 8X12 TR	155-1075751
C11	SMD 220NF 50V Z% CER CAP Y5V 0805 TR	950-2245951
C12	470UF 35V 20% 5MM RD/EL CAP 10X20 L	855-4773950
C14	SMD 220NF 50V Z% CER CAP Y5V 0805 TR	950-2245951
C15	SMD 100NF 50V Z% CER CAP Y5V 0805 TR	950-1045951
C16	330UF 25V 20% 5MM RD/EL LXF 10X16 ST	857-3372751
C18	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C19	680UF 10V 20% 5MM RD/EL LXF 10X16 ST	857-6871751
C20	100UF 50V 20% 5MM RD/EL CAP 8X12 TR	155-1075751
C21	SMD 68PF 50V 5% CER CAP COG 0805 TR	950-6805501
C22	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C23	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C24	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C25	100UF 50V 20% 5MM RD/EL CAP 8X12 TR	155-1075751
C26	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C27	100UF 50V 20% 5MM RD/EL CAP 8X12 TR	155-1075751
C28	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C29	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C30	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C31	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C32	SMD 100NF 50V Z% CER CAP Y5V 0805 TR	950-1045951
C33	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C34	SMD 22NF 50V 10% CER CAP X7R 0805 TR	950-2235621
C35	SMD 330PF 50V 5% CER CAP COG 0805 TR	950-3315501
C36	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C37	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C38	680PF 2KV 10% 7.5MM CER CAP TR	159-6819671
C39	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C41	SMD 330PF 50V 5% CER CAP COG 0805 TR	950-3315501
C42	SMD 100NF 50V Z% CER CAP Y5V 0805 TR	950-1045951
C43	SMD 330PF 100V 10% CER CAP X7R 0805 TR	950-3317621
C100	100UF 50V 20% 5MM RD/EL CAP 8X12 TR	155-1075751
C101	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C102	SMD 33PF 50V 5% CER CAP COG 0805 TR	950-3305501
C103	SMD 33PF 50V 5% CER CAP COG 0805 TR	950-3305501
C104	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C105	220UF 25V 20% 5MM RD/EL CAP 8X12 TR	155-2272751
C106	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C107	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C109	1U0F 50V 20% 5MM M/LAYER CER CAP TR	157-1055751
C110	SMD 100NF 50V Z% CER CAP Y5V 0805 TR	950-1045951
C111	SMD 100NF 50V Z% CER CAP Y5V 0805 TR	950-1045951
C112	SMD 22PF 50V 5% CER CAP COG 0805 TR	950-2205501
C113	SMD 56PF 50V 5% CER CAP COG 0805 TR	950-5605501
C114	1000UF 16V 20% 5MM RD/EL CAP 10X17 TR	155-1081750
C116	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C117	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C118	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C119	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C120	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C121	SMD 330PF 50V 5% CER CAP COG 0805 TR	950-3315501
C200	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C201	SMD 3N3F 50V 5% CER CAP X7R 0805 TR	950-3325521
C202	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C203	SMD 82PF 50V 5% CER CAP R2H 0805 TR	950-8205561
C204	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C205	SMD 18PF 50V 5% CER CAP COG 0805 TR	950-1805501
C206	SMD 22PF 50V 5% CER CAP COG 0805 TR	950-2205501
C207	SMD 100NF 50V Z% CER CAP Y5V 0805 TR	950-1045951
C208	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C209	SMD 220NF 50V Z% CER CAP Y5V 0805 TR	950-2245951
C210	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C211	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C212	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C213	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C215	SMD 5P6F 50V C% CER CAP COG 0805 TR	950-0565301
C216	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C217	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C218	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C219	SMD 1P8F 50V C% CER CAP COG 0805 TR	950-0185301
C220	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C221	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C222	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C223	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C224	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C225	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C226	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C227	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C228	SMD 22PF 50V 5% CER CAP COG 0805 TR	950-2205501
C229	SMD 27PF 50V 5% CER CAP COG 0805 TR	950-2705501
C230	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C231	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C232	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C358	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C500	SMD 8N2F 50V 10% CER CAP X7R 0805 TR	950-8225621
C501	SMD 8N2F 50V 10% CER CAP X7R 0805 TR	950-8225621
C502	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C503	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C504	100UF 50V 20% 5MM RD/EL CAP 8X12 TR	155-1075751
C505	SMD 22PF 50V 5% CER CAP COG 0805 TR	950-2205501
C506	10UF 16V 20% 5MM RD/EL CAP 5X11 TR	156-1061755
C507	SMD 22PF 50V 5% CER CAP COG 0805 TR	950-2205501
C508	SMD 2N7F 50V 5% CER CAP X7R 0805 TR	950-2725521
C509	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C510	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C511	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C512	470UF 16V 20% 5MM RD/EL CAP 10X16 TR	155-4771751
C513	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C514	SMD 22PF 50V 5% CER CAP COG 0805 TR	950-2205501
C515	SMD 22PF 50V 5% CER CAP COG 0805 TR	950-2205501
C516	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C517	10UF 16V 20% 5MM RD/EL CAP 5X11 TR	156-1061755
C518	SMD 2N7F 50V 5% CER CAP X7R 0805 TR	950-2725521
C520	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C521	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C522	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C523	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C524	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-224295
C527	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-106575
C528	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-106575
C529	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-106575
C530	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-103562
C531	SMD 33PF 50V 5% CER CAP COG 0805 TR	950-330550
C532	SMD 33PF 50V 5% CER CAP COG 0805 TR	950-330550
C534	SMD 100NF 50V Z% CER CAP Y5V 0805 TR	950-104595
C535	SMD 100NF 50V Z% CER CAP Y5V 0805 TR	950-104595
C536	SMD 68PF 50V 5% CER CAP COG 0805 TR	950-680550
C537	SMD 12PF 50V 5% CER CAP COG 0805 TR	950-120550
C538	SMD 39PF 50V 5% CER CAP COG 0805 TR	950-390550
C539	SMD 27PF 50V 5% CER CAP COG 0805 TR	950-270550
C540	SMD 33PF 50V 5% CER CAP COG 0805 TR	950-330550
C541	SMD 82PF 50V 5% CER CAP COG 0805 TR	950-820550
C542	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-106575

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C543	SMD 0R0 0.1W LINK 0805 TR	940-0000501
C544	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C545	100UF 50V 20% 5MM RD/EL CAP 8X12 TR	155-1075751
C546	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C547	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C548	4U7F 50V 20% 5MM RD/EL CAP 5X11 TR	155-4755751
C549	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C550	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C551	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C552	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C553	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C554	10UF 50V 20% 5MM RD/EL CAP 5X11 TR	155-1065751
C555	SMD 27PF 50V 5% CER CAP COG 0805 TR	950-2705501
C556	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C557	SMD 1N5F 50V 10% CER CAP X7R 0805 TR	950-1525621
C558	SMD 8N2F 50V 10% CER CAP X7R 0805 TR	950-8225621
C559	SMD 1N5F 50V 10% CER CAP X7R 0805 TR	950-1525621
C560	SMD 1N5F 50V 10% CER CAP X7R 0805 TR	950-1525621
C561	SMD 8N2F 50V 10% CER CAP X7R 0805 TR	950-8225621
C562	SMD 1N5F 50V 10% CER CAP X7R 0805 TR	950-1525621
C563	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C564	SMD 27PF 50V 5% CER CAP COG 0805 TR	950-2705501
C600	1U0F 50V 20% 5MM RD/EL CAP 5X11 TR	155-1055751
C601	47UF 35V 20% 5MM RD/EL CAP 7X11 TR	155-4763751
C602	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C603	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C604	1U0F 50V 20% 5MM RD/EL CAP 5X11 TR	155-1055751
C605	SMD 8P2F 50V C% CER CAP COG 0805 TR	950-0825301
C606	SMD 8P2F 50V C% CER CAP COG 0805 TR	950-0825301
C607	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C608	47UF 35V 20% 5MM RD/EL CAP 7X11 TR	155-4763751
C609	SMD 33PF 50V 5% CER CAP COG 0805 TR	950-3305501
C610	SMD 33PF 50V 5% CER CAP COG 0805 TR	950-3305501
C612	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C613	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C614	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C615	SMD 330PF 50V 5% CER CAP COG 0805 TR	950-3315501
C616	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C617	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C618	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C619	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C620	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C621	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C622	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C623	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C624	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C625	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C626	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C627	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C628	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C629	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C630	SMD 220PF 50V 5% CER CAP COG 0805 TR	950-2215501
C702	SMD 10NF 50V 10% CER CAP X7R 0805 TR	950-1035621
C703	SMD 47PF 50V 5% CER CAP COG 0805 TR	950-4705501
C704	SMD 22PF 50V 5% CER CAP COG 0805 TR	950-2205501
C705	SMD 220NF 25V Z% CER CAP Y5V 0805 TR	950-2242951
C706	SMD 330PF 50V 5% CER CAP COG 0805 TR	950-3315501
C707	SMD 330PF 50V 5% CER CAP COG 0805 TR	950-3315501
C708	SMD 100NF 25V Z% CER CAP Y5V 0805 TR	950-1042951
C710	100UF 50V 20% 5MM RD/EL CAP 8X12 TR	155-1075751
C711	100UF 50V 20% 5MM RD/EL CAP 8X12 TR	155-1075751

Diodes

D1	DIODE-1N4007 TR	120-0400701
D2	DIODE-1N4007 TR	120-0400701
D3	DIODE-1N4007 TR	120-0400701
D4	DIODE-1N4007 TR	120-0400701
D5	DIODE-UG2D ULTRAFAST EFFIC. RECTIFIER TR	120-0000201
D6	DIODE-BYV96D (PHILIPS) TR	120-0009611
D7	15V 2% 400MW ZENER DIODE TR	125-0150201
D8	DIODE-BAV21 TR	120-0002101
D9	DIODE-BYV96D (PHILIPS) TR	120-0009611
D13	DIODE-1N4007 TR	120-0400701
D14	DIODE-1N4007 TR	120-0400701
D15	8V2 5% 400MW ZENER DIODE TR	125-0082501
D16	DIODE-1N4148 75V 75MA SIGNAL TR	120-0414801
D17	5V1 2% 400MW ZENER DIODE TR	125-0051201
D18	DIODE-1N4007 TR	120-0400701
D19	DIODE-UG2D ULTRAFAST EFFIC. RECTIFIER TR	120-0000201
D20	200V 3.25W ZENER DIODE BZT03-C200 TR	125-0320001
D21	DIODE-UG2D ULTRAFAST EFFIC. RECTIFIER TR	120-0000201
D200	SMD DIODE-BB515 MINI PLAST TR	912-0051501
D202	SMD DIODE-BAV99 DUAL SOT-23 TR	912-0009951
D503	1V4 5% 330MW ZENER DIODE BZV86 TR	125-0014501
D504	1V4 5% 330MW ZENER DIODE BZV86 TR	125-0014501
D600	4V7 5% 400MW ZENER DIODE TR	125-0047501
D601	12V 5% 400MW ZENER DIODE TR	125-0120501
D602	4V7 5% 400MW ZENER DIODE TR	125-0047501
D603	4V7 5% 400MW ZENER DIODE TR	125-0047501
D604	4V7 5% 400MW ZENER DIODE TR	125-0047501
D605	4V7 5% 400MW ZENER DIODE TR	125-0047501
D606	4V7 5% 400MW ZENER DIODE TR	125-0047501
D607	12V 5% 400MW ZENER DIODE TR	125-0120501
D608	SMD DIODE-BAS16 SWIT SOT-23 TR	912-0001651

Inductors

L3	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
L4	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
L6	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
L8	47UH 10% RADIAL INDUCTOR TSL0709 TR	131-0470611
L9	47UH 10% RADIAL INDUCTOR TSL0709 TR	131-0470611
L10	10UH 5% AXIAL INDUCTOR 0305 TR	130-0100501
L11	10UH 5% AXIAL INDUCTOR 0305 TR	130-0100501
L12	200NH-COIL (GOLD) AIR WOUND (PEDOKA)	134-0200080
L13	82UH 10% AXIAL INDUCTOR (TDK) T	134-0820601
L100	10UH 5% AXIAL INDUCTOR 0305 TR	130-0100501
L102	47UH 5% AXIAL INDUCTOR 0305 TR	130-0470531
L103	1UH 5% AXIAL INDUCTOR 0305 TR	130-0010501
L200	ADJ SOUND COIL 10UH +-5% HKS-999-141	133-0100051
L201	7NH-COIL TINNED AIR WOUND(NEW DESIGN)	134-0007075
L202	10UH 5% AXIAL INDUCTOR 0305 TR	130-0100501
L203	33UH 5% AXIAL INDUCTOR 0305 TR	130-0330501
L204	200NH-COIL (GOLD) AIR WOUND (PEDOKA)	134-0200080
L501	22UH 10% AXIAL INDUCTOR 0305 TR	130-0220601
L502	15UH 5% AXIAL INDUCTOR 0305 TR	130-0150501
L503	47UH 5% AXIAL INDUCTOR 0305 TR	130-0470531
L504	6U8H 5% AXIAL INDUCTOR TR	130-0068501
L601	1UH 5% AXIAL INDUCTOR 0305 TR	130-0010501
L602	15UH 5% AXIAL INDUCTOR 0305 TR	130-0150501

Links

J200	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
J600	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
J601	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
J602	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK100	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK101	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK103	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK104	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK105	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK106	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK109	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK110	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK112	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK115	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK116	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK117	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902

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LK118	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK119	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK121	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK122	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
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LK154	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK180	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK181	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK207	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK210	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK211	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
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LK213	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
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LK220	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
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LK222	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
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LK232	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK233	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK234	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK235	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
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LK237	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
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LK239	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
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LK265	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
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LK282	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK283	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK284	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
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LK288	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK289	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK290	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK291	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK292	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK293	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK294	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK295	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK296	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK297	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK298	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK300	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK301	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK302	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK304	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK305	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK306	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK307	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK309	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK310	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK311	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK312	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
LK313	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902

Connectors

PL1	PIN HEADER- 5WAY (PIN 4 REMOVED)	161-1000503
PL601	PHONO SOCKET-DUAL (JP-A2V02A) RED/WHI	165-2000201
SK1	△ MAINS INLET SKT 2.5A/250V	875-0778231
SK600	SCART SOCKET-JR21A7 21PIN R/ANGLE	163-2102113
SK601	SCART SOCKET-JR21A7 21PIN R/ANGLE	163-2102113
SK603	SCART SOCKET-JR21A7 21PIN R/ANGLE	163-2102113

Transistors

Q1	TRANSISTOR-ZPS749 PNP POWER TO-92 TR	110-0074931
Q2	TRANSISTOR-TIP31A NPN POWER TR	110-1003101
Q3	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q4	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q5	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q6	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q7	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q8	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q9	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q100	SMD N CHAN FET-ZVN3306F SOT-23	911-0330651
Q101	SMD TRANS-BC845B/2SC2412KT146R SOT-23 TR	911-1084651
Q102	TRANSISTOR-ZPS749 PNP POWER TO-92 TR	110-0074931
Q103	TRANSISTOR-ZPS749 PNP POWER TO-92 TR	110-0074931
Q104	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q105	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q106	SMD TRANSISTOR-BC856B PNP SOT-23 TR	911-1085651
Q107	SMD TRANSISTOR-BC856B PNP SOT-23 TR	911-1085651
Q200	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q500	SMD TRANSISTOR-BC856B PNP SOT-23 TR	911-1085651
Q501	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q502	SMD TRANSISTOR-BC856B PNP SOT-23 TR	911-1085651
Q503	SMD TRANSISTOR-BC856B PNP SOT-23 TR	911-1085651
Q504	SMD TRANSISTOR-BC856B PNP SOT-23 TR	911-1085651
Q600	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q601	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651

Q602	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q603	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q604	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q605	TRANSISTOR-BC547B NPN TO-92 TR	110-1054701
Q606	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q607	SMD TRANSISTOR-BC856B PNP SOT-23 TR	911-1085651
Q608	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q609	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q610	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651
Q700	SMD TRANS-BC846B/2SC2412KT146R SOT-23 TR	911-1084651

Resistors

R1	10R 2W +-25% METOX NON-SPIRAL RES		143-1007821
R2	SMD 10R 0.1W 5% RES 0805	TR	940-1000501
R3	SMD 47R 0.1W 5% RES 0805	TR	940-4700501
R5	SMD 220K 0.1W 5% RES 0805	TR	940-2240501
R6	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R7	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R8	∆ 10M 0.5W 5% METAL FILM RES VR37	TR	142-1065511
R9	SMD 15K 0.1W 5% RES 0805	TR	940-1530501
R10	1K 0.25W 5% CARBON FILM RES	TR	140-1022501
R11	1K 0.25W 5% CARBON FILM RES	TR	140-1022501
R12	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R13	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R14	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R15	SMD 220R 0.1W 5% RES 0805	TR	940-2210501
R16	1R5 0.5W 5% CARBON FILM RES	TR	140-0155501
R17	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R18	SMD 47K 0.1W 1% RES 0805	TR	940-4730101
R19	SMD 10K 0.1W 1% RES 0805	TR	940-1030101
R21	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R22	SMD 2K2 0.1W 5% RES 0805	TR	940-2220501
R23	SMD 100K 0.1W 5% RES 0805	TR	940-1040501
R24	SMD 82K 0.1W 1% RES 0805	TR	940-8230101
R25	SMD 2K2 0.1W 5% RES 0805	TR	940-2220501
R26	SMD 47K 0.1W 1% RES 0805	TR	940-4730101
R27	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R28	SMD 82K 0.1W 1% RES 0805	TR	940-8230101
R29	SMD 82K 0.1W 1% RES 0805	TR	940-8230101
R30	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R31	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R32	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R33	4K7 0.25W 5% CARBON FILM RES	TR	140-4722501
R34	SMD 1K5 0.1W 1% RES 0805	TR	940-1520101
R35	SMD 22K 0.1W 1% RES 0805	TR	940-2230101
R36	SMD 100K 0.1W 5% RES 0805	TR	940-1040501
R37	SMD 1M 0.1W 5% RES 0805	TR	940-1050501
R38	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R39	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R42	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R43	SMD 1M 0.1W 5% RES 0805	TR	940-1050501
R44	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R100	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R101	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R104	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R105	SMD 2K2 0.1W 5% RES 0805	TR	940-2220501
R106	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R107	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R108	SMD 22K 0.1W 5% RES 0805	TR	940-2230501
R110	SMD 270R 0.1W 5% RES 0805	TR	940-2710501
R111	SMD 470R 0.1W 5% RES 0805	TR	940-4710501
R112	SMD 470R 0.1W 5% RES 0805	TR	940-4710501
R113	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R114	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R115	1K 0.25W 5% CARBON FILM RES	TR	140-1022501
R116	1K 0.25W 5% CARBON FILM RES	TR	140-1022501
R117	1K 0.25W 5% CARBON FILM RES	TR	140-1022501
R119	1K 0.25W 5% CARBON FILM RES	TR	140-1022501
R119	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R120	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R121	SMD 22R 0.1W 5% RES 0805	TR	940-2200501
R122	SMD 22R 0.1W 5% RES 0805	TR	940-2200501
R123	SMD 330R 0.1W 5% RES 0805	TR	940-3310501
R124	SMD 3K3 0.1W 5% RES 0805	TR	940-3320501
R125	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R125	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R127	SMD 330R 0.1W 5% RES 0805	TR	940-3310501
R200	SMD 15K 0.1W 5% RES 0805	TR	940-1530501
R201	SMD 1K8 0.1W 5% RES 0805	TR	940-1820501
R202	SMD 12K 0.1W 5% RES 0805	TR	940-1230501
R203	SMD 22K 0.1W 5% RES 0805	TR	940-2230501
R204	SMD 22K 0.1W 5% RES 0805	TR	940-2230501
R205	SMD 12K 0.1W 5% RES 0805	TR	940-1230501
R206	SMD 22K 0.1W 5% RES 0805	TR	940-2230501
R207	SMD 12K 0.1W 5% RES 0805	TR	940-1230501
R208	SMD 2K2 0.1W 5% RES 0805	TR	940-2220501
R210	SMD 100R 0.1W 5% RES 0805	TR	940-1010501
R211	SMD 100R 0.1W 5% RES 0805	TR	940-1010501
R212	SMD 22R 0.1W 5% RES 0805	TR	940-2200501
R213	SMD 150K 0.1W 5% RES 0805	TR	940-1540501
R214	SMD 470R 0.1W 5% RES 0805	TR	940-4710501
R215	SMD 470R 0.1W 5% RES 0805	TR	940-4710501
R217	SMD 75R 0.1W 5% RES 0805	TR	940-7500501
R219	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R220	SMD 22R 0.1W 5% RES 0805	TR	940-2200501
R221	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R230	SMD INDUCTOR-1.2UH 5% HIGH SRF 230MHZ		913-0012501
R500	SMD 36K 0.1W 5% RES 0805	TR	940-3630501
R501	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R502	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R503	SMD 36K 0.1W 5% RES 0805	TR	940-3630501
R504	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R505	SMD 82K 0.1W 5% RES 0805	TR	940-8230501
R506	SMD 180K 0.1W 5% RES 0805	TR	940-1840501
R507	SMD 27K 0.1W 5% RES 0805	TR	940-2730501
R508	SMD 560K 0.1W 5% RES 0805	TR	940-5640501
R509	SMD 560K 0.1W 5% RES 0805	TR	940-5640501
R510	SMD 180K 0.1W 5% RES 0805	TR	940-1840501
R511	SMD 82K 0.1W 5% RES 0805	TR	940-8230501
R512	SMD 47K5 0.1W 1% RES 0805	TR	940-4730151
R513	SMD 27K 0.1W 5% RES 0805	TR	940-2730501
R514	SMD 560K 0.1W 5% RES 0805	TR	940-5640501
R515	SMD 560K 0.1W 5% RES 0805	TR	940-5640501
R516	SMD 3K3 0.1W 5% RES 0805	TR	940-3320501
R517	SMD 27K 0.1W 5% RES 0805	TR	940-2730501
R518	SMD 1M2 0.1W 5% RES 0805	TR	940-1250501
R519	SMD 1M2 0.1W 5% RES 0805	TR	940-1250501
R520	SMD 27K 0.1W 5% RES 0805	TR	940-2730501
R521	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R522	SMD 3K3 0.1W 5% RES 0805	TR	940-3320501
R523	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R524	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R525	SMD 3K9 0.1W 5% RES 0805	TR	940-3920501
R526	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R527	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R528	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R530	SMD 3K9 0.1W 5% RES 0805	TR	940-3920501
R531	SMD 510R 0.1W 5% RES 0805	TR	940-5110501
R532	SMD 510R 0.1W 5% RES 0805	TR	940-5110501
R533	SMD 390R 0.1W 5% RES 0805	TR	940-3910501
R534	SMD 6K2 0.1W 5% RES 0805	TR	940-6220501
R535	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R536	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R537	SMD 12K 0.1W 5% RES 0805	TR	940-1230501
R538	SMD 470R 0.1W 5% RES 0805	TR	940-4710501

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R539	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R540	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R546	SMD 43K 0.1W 5% RES 0805	TR	940-4330501
R547	SMD 1K5 0.1W 5% RES 0805	TR	940-1520501
R548	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R549	SMD 43K 0.1W 5% RES 0805	TR	940-4330501
R550	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R551	SMD 1K5 0.1W 5% RES 0805	TR	940-1520501
R552	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R553	SMD 100R 0.1W 5% RES 0805	TR	940-1010501
R554	SMD 100R 0.1W 5% RES 0805	TR	940-1010501
R555	SMD 100R 0.1W 5% RES 0805	TR	940-1010501
R556	SMD 100R 0.1W 5% RES 0805	TR	940-1010501
R557	SMD 100R 0.1W 5% RES 0805	TR	940-1010501
R558	SMD 100R 0.1W 5% RES 0805	TR	940-1010501
R559	SMD 100R 0.1W 5% RES 0805	TR	940-1010501
R560	SMD 100R 0.1W 5% RES 0805	TR	940-1010501
R561	SMD 100R 0.1W 5% RES 0805	TR	940-1010501
R562	SMD 100R 0.1W 5% RES 0805	TR	940-1010501
R600	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R601	100R 0.25W 5% CARBON FILM RES	TR	140-1012501
R602	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R603	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R604	SMD 510R 0.1W 5% RES 0805	TR	940-5110501
R605	SMD 100K 0.1W 5% RES 0805	TR	940-1040501
R606	SMD 100K 0.1W 5% RES 0805	TR	940-1040501
R607	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R608	SMD 470R 0.1W 5% RES 0805	TR	940-4710501
R609	SMD 75R 0.1W 5% RES 0805	TR	940-7500501
R610	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R611	SMD 75R 0.1W 5% RES 0805	TR	940-7500501
R612	470R 0.25W 5% CARBON FILM RES	TR	140-4712501
R613	470R 0.25W 5% CARBON FILM RES	TR	140-4712501
R617	SMD 75R 0.1W 5% RES 0805	TR	940-7500501
R618	SMD 75R 0.1W 5% RES 0805	TR	940-7500501
R619	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R620	SMD 22K 0.1W 5% RES 0805	TR	940-2230501
R621	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R622	SMD 75R 0.1W 5% RES 0805	TR	940-7500501
R623	SMD 75R 0.1W 5% RES 0805	TR	940-7500501
R624	SMD 470R 0.1W 5% RES 0805	TR	940-4710501
R625	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R626	SMD 22K 0.1W 5% RES 0805	TR	940-2230501
R627	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R628	SMD 22K 0.1W 5% RES 0805	TR	940-2230501
R629	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R630	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R631	SMD 100R 0.1W 5% RES 0805	TR	940-1010501
R632	220R 0.25W 5% CARBON FILM RES	TR	140-2212501
R633	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R634	SMD 1K 0.1W 5% RES 0805	TR	940-1020501
R635	SMD 100K 0.1W 5% RES 0805	TR	940-1040501
R636	SMD 2K2 0.1W 5% RES 0805	TR	940-2220501
R637	SMD 56K 0.1W 5% RES 0805	TR	940-5630501
R638	SMD 47K 0.1W 1% RES 0805	TR	940-4730101
R639	SMD 470R 0.1W 5% RES 0805	TR	940-4710501
R640	SMD 100K 0.1W 5% RES 0805	TR	940-1040501
R641	SMD 100K 0.1W 5% RES 0805	TR	940-1040501
R642	SMD 22K 0.1W 5% RES 0805	TR	940-2230501
R646	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R647	470R 0.25W 5% CARBON FILM RES	TR	140-4712501
R648	470R 0.25W 5% CARBON FILM RES	TR	140-4712501
R700	SMD 330R 0.1W 5% RES 0805	TR	940-3310501
R701	SMD 680R 0.1W 5% RES 0805	TR	940-6810501
R702	100R 0.25W 5% CARBON FILM RES	TR	140-1012501
R703	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R704	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R705	SMD 10K 0.1W 5% RES 0805	TR	940-1030501
R706	SMD 220R 0.1W 5% RES 0805	TR	940-2210501
R707	SMD 1K5 0.1W 5% RES 0805	TR	940-1520501
R708	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R709	SMD 4K7 0.1W 5% RES 0805	TR	940-4720501
R800	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R801	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R806	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R807	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R813	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R819	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R824	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R826	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R828	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R846	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R847	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R894	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R896	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R897	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R898	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R899	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R900	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R901	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R902	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R904	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R905	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R906	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R909	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R910	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R911	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R912	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R913	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R914	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R915	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R916	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R917	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R918	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R919	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R920	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R921	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R923	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R924	SMD 220K 0.1W 5% RES 0805	TR	940-2240501
R925	SMD 220K 0.1W 5% RES 0805	TR	940-2240501
R927	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R929	SMD 10M 0.1W 5% RES 0805	TR	940-1060501
R930	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R931	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R932	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R933	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R934	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R935	SMD 0R0 0.1W LINK 0805	TR	940-0000501
R936	SMD 0R0 0.1W LINK 0805	TR	940-0000501

ICs

U1	PWR-TOP223Y TOPSWITCH (TO-220)	109-0022301
U2	LM358/KA358 DUAL OP AMP LOW POWER	100-0035800
U3	VOL/REG LM7812 +12V 1.5A TO-220	105-0781200
U100	LM7001 FS CHIP	109-0700101
U200	TDA8722 I2C BUS PROG.MOD.FOR -VE VID C2	909-0872211
U201	"M"ANTENNA SIGNAL PROCESSOR TDA 8725T	909-0872501
U500	STV0056A SOUND & VIDEO PROCESSOR	109-0005501
U600	M35010-001SP DISPLAY CONT (MISUBISHI)	109-0350100
U700	8663 PROC MSS228-G DISEQC (809-8663130)	609-8663130
U701	24C64 64K EE	104-0246400
U702	SMD IC-BU4S66 SINGLE ANALOG SWITCH SO	906-0406610

Misc. Components

FS1	△FUSE F1AL/250V FAST BLOW BUSSMANN	201-2521000
FS2	△ FUSE F2AL/250V FAST BLOW	201-2521100
HS1	HEATSINK-TV216 POWERFIN (TO220)	202-0021600
IR1	SONY -IR REC MODULE (SBX 8030-F)	215-8030000
LED700	LED - RED 5MM HIGH EFFICIENCY	200-0010500
LED701	LED - GREEN 5MM H/EFF EL333GD	200-0110501
MOD1	MODULATOR BRACKET MSS100 ISS2	315-0100101
MT1	EARTHING PLATE (1ST USED ON PRIMA)	249-1001600
SW700	SWITCH-B3F3152 PCB SUBMIN 150GM (YEL)	204-0315211
SW701	SWITCH-B3F3152 PCB SUBMIN 150GM (YEL)	204-0315211
SW702	SWITCH-B3F3152 PCB SUBMIN 150GM (YEL)	204-0315211
T1	△ MAINS FILTER-(UF2327S-253-YOR5)"TDK"	232-2327000
T2	△ TRANSFORMER (SM)	237-5302001
TC1	SMD 0R0 0.1W LINK 0805 TR	940-0000501
X100	XTAL 5.625MHZ HC49U 50/50/10/ 30PF PAR	170-0056250
X600	XTAL 17.734MHZ HC49U 20/30/10 10PF PAR	170-0177341
X700	CRYSTAL-4MHZ HC49U 50/50/-10+60 30PF PAR	170-0040000

Spares - Mechanical Parts List

1 OFF	CARTON - MSS228-G	412-1006100
1 OFF	COVER - PRIMA	312-1001800
1 OFF	BASE - PRIMA M/C VC II ISSUE 2	321-1002301
1 OFF	FRONT PANEL - MSS228	360-1006100
1 OFF	△ EURO-MAINS LEAD 8"+2FLAT PIN PLUG W/B	191-2015280
1 OFF	CABLE0COAX UHF M-TO-F 1.5M BLACK	198-0015121
2 OFF	BATTERY-1.5 V AAA	239-0015000
1 OFF	HALF NUT-3/8 FORM 32 TOI.2A	240-1380011
4 OFF	BUMPON-SJ5003 SMALL BLACK DOME	208-5003010
3 OFF	SELF-TAP SCREW - 6 X 1/4" P/PAN BZP TYPE B	244-6140001
2 OFF	PLASTITE SCREW-4 X 1/4 POZI PAN BLACK	245-4140011
6 OFF	SCREW-M3 X 8 P/P TAP.C/W WASHER	246-3080011
2 OFF	POLYSTYRENE DIGITAL WITH CUTOUTS	442-5400000
1 OFF	△ MANUAL - MSS228 EN/SP/FR/TU/GE/IT	502-1006100
1 OFF	PROG LIST SHEET - WORLD —— APRIL 97	504-1235032
1 OFF	HANDSET ANALOGUE PACE	699-0000100
1 OFF	BAG-POLYTHENE FOR LEADS	400-1080400
1 OFF	BAG-POLYTHENE FOR MKII SAT.REC. 14X17"	400-1000200
1 OFF	PILLAR-SP1-6-01 STAND-OFF (RICHO)	248-1141700

Differences between MSS 228-G B1 and 7A

Deleted Components

The following components are not present in the B1 version of the main board.

C715, C716, LK314, LK316, R710, R711, R712, R713, R714, R715, R716, R717, R718, R719, R720, R721, R937, R938, R939, R940, R941, R942, R943 and R944.

Additional Components

The following components have been added in the B1 version of the main board.

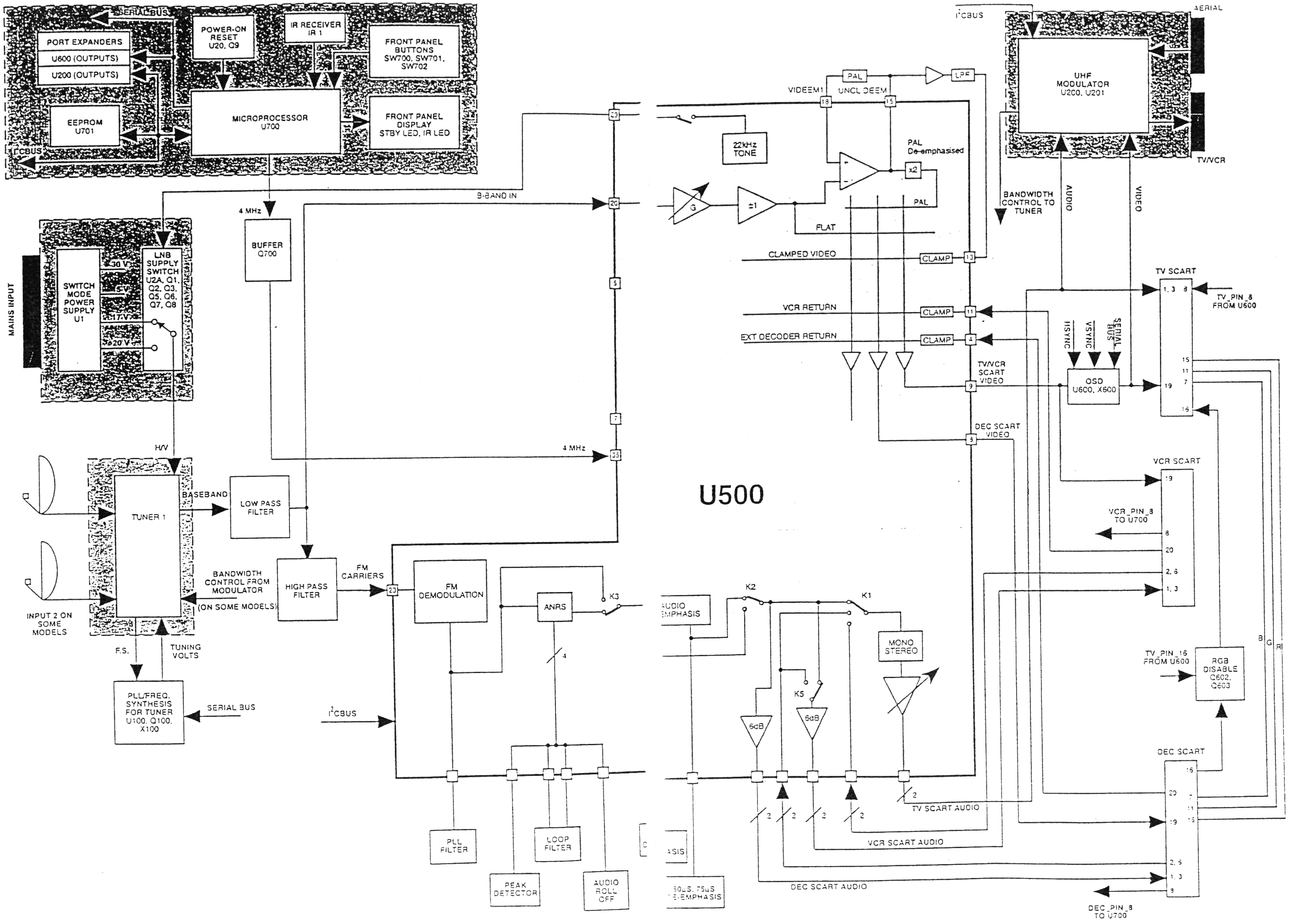
C101	SMD 1N0F 50V 5% CER CAP COG 0805 TR	950-1025501
C102	SMD 33PF 50V 5% CER CAP COG 0805 TR	950-3305501
C103	SMD 33PF 50V 5% CER CAP COG 0805 TR	950-3305501
C106	SMD 100PF 50V 5% CER CAP COG 0805 TR	950-1015501
C109	1U0F 50V 20% 5MM M/LAYER CER CAP TR	157-1055751
C114	1000UF 16V 20% 5MM RD/EL CAP 10X17 TR	155-1081750
C121	SMD 330PF 50V 5% CER CAP COG 0805 TR	950-3315501
LK302	TINNED COPPER WIRE LINKS 0.61MM DIA	999-1099902
Q100	SMD N CHAN FET-ZVN3306F SOT-23	911-0330651
R100	SMD 4K7 0.1W 5% RES 0805 TR	940-4720501
R101	SMD 1K 0.1W 5% RES 0805 TR	940-1020501
R104	SMD 10K 0.1W 5% RES 0805 TR	940-1030501
R105	SMD 2K2 0.1W 5% RES 0805 TR	940-2220501
R112	SMD 470R 0.1W 5% RES 0805 TR	940-4710501
U100	LM7001 FS CHIP	109-0700101
X100	XTAL 5.625MHZ HC49U 50/50/10/ 30PF PAR	170-0056250

Changed Components

The following components have been changed in the B1 version of the main board.

C107	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R106	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R107	SMD 0R0 0.1W LINK 0805 TR	940-0000501
R108	SMD 0R0 0.1W LINK 0805 TR	940-0000501
U700	8663 PROC MSS228-GLT DISECQ(809-8663131)	809-8663131

Main Block Diagram


SERIAL BUS
PORT EXPANDERS
U600 (OUTPUTS)
U200 (OUTPUTS)
EEPROM
U701
I²CBUS
POWER-ON
RESET
U20, Q9
IR RECEIVER
IR 1
FRONT PANEL
BUTTONS
SW700, SW701,
SW702
MICROPROCESSOR
U700
FRONT PANEL
DISPLAY
STBY LED, IR LED
MAINS INPUT
SWITCH
MODE
POWER
SUPPLY
U1
30 V
17 V
20 V
LNB
SUPPLY
SWITCH
U2A, Q1,
Q2, Q3,
Q5, Q6,
Q7, Q8
4 MHz
BUFFER
Q700
B-BAND IN
4 MHz
H/V
TUNER 1
BASEBAND
LOW PASS
FILTER
INPUT 2 ON
SOME
MODELS
BANDWIDTH
CONTROL FROM
MODULATOR
(ON SOME MODELS)
HIGH PASS
FILTER
FM
CARRIERS
F.S.
TUNING
VOLTS
PLL/FREQ.
SYNTHESIS
FOR TUNER
U100, Q100,
X100
SERIAL BUS
I²CBUS
FM
DEMODULATION
ANRS
K3
4
PLL
FILTER
PEAK
DETECTOR
LOOP
FILTER
AUDIO
ROLL
OFF
AUDIO
EMPHASIS
ASIS
50uS, 75uS
DE-EMPHASIS
U500
23
20
5
7
35
13
11
4
9
3
15
VIDEEM1
UNCL DEEM
PAL
LPF
22kHz
TONE
G
±1
PAL
De-emphasised
x2
PAL
FLAT
CLAMPED VIDEO
CLAMP
VCR RETURN
CLAMP
EXT DECODER RETURN
CLAMP
TV/VCR
SCART
VIDEO
DEC SCART
VIDEO
K2
K1
6dB
K5
6dB
MONO
STEREO
2
TV SCART AUDIO
VCR SCART AUDIO
DEC SCART AUDIO
I²CBUS
AERIAL
UHF
MODULATOR
U200, U201
TV/VCR
BANDWIDTH
CONTROL TO
TUNER
AUDIO
VIDEO
HSYNC
VSYNC
SERIAL
BUS
OSD
U600, X600
TV SCART
1, 3
8
15
11
7
19
16
TV_PIN_8
FROM U600
VCR SCART
19
VCR_PIN_8
TO U700
8
20
2, 6
1, 3
B
G
R
TV_PIN_16
FROM U600
RGB
DISABLE
Q602,
Q603
DEC SCART
15
20
7
11
19
15
2, 6
1, 3
8
DEC_PIN_8
TO U700

***	PRIMA M/C VCII	PRIMA PACE	MSS228
C528	100nF	100nF	N/F
C529	10uF 50V 20x	N/F	10uF 50V 20x
C542	10uF 50V 20x	N/F	10uF 50V 20x
C546	10uF 50V 20x	N/F	10uF 50V 20x
C547	10uF 50V 20x	N/F	10uF 50V 20x
C550	10uF 50V 20x	N/F	10uF 50V 20x
C551	10uF 50V 20x	N/F	10uF 50V 20x
C553	10uF 50V 20x	N/F	10uF 50V 20x
C554	10uF 50V 20x	N/F	10uF 50V 20x
C631	220pF	N/F	220pF
C632	220pF	N/F	220pF
D5	MUR120	MUR120	UG2D
D19	MUR120	MUR120	UG2D
D21	MUR120	MUR120	UG2D
HS2	HEATSINK	HEATSINK	N/F

***	PRIMA M/C VCII	PRIMA PACE	MSS228
HS3	HEATSINK	HEATSINK	N/F
L3	47uH	47uH	0R0 0W25 5x
L4	47uH	47uH	0R0 0W25 5x
L6	47uH	47uH	0R0 0W25 5x
L302	10uH	10uH	N/F
Q310	BC848B	BC848B	N/F
Q600	BC848B	N/F	BC848B
Q605	BC547B	N/F	BC547B
R8	•A• 4M7 VR37	•A• 4M7 VR37	•A• 10M VR37
R230	1K0 0805	1K0 0805	1u2M 0805
R332	220R 0W25	220R 0W25	N/F
R333	330R	330R	N/F
R555	100R	N/F	100R
R556	100R	N/F	100R
R557	100R	N/F	100R

***	PRIMA M/C VCII	PRIMA PACE	MSS228
R558	100R	N/F	100R
R600	1K0	N/F	1K0
R630	1K0	N/F	1K0
R631	100R	N/F	100R
R632	220R 0W25	N/F	220R 0W25
R643	0R0	N/F	0R0
R644	0R0	N/F	0R0
R645	0R0	N/F	0R0
R903	0R0	N/F	0R0
R907	0R0 0805	0R0 0805	N/F
R908	0R0 0805	0R0 0805	N/F
U1	TOP201	TOP201	TOP223
U700	8663 PROC	8661	8663 PROC
U701	24C32 32K EE	24C16 16K EE	24C64 64K EE

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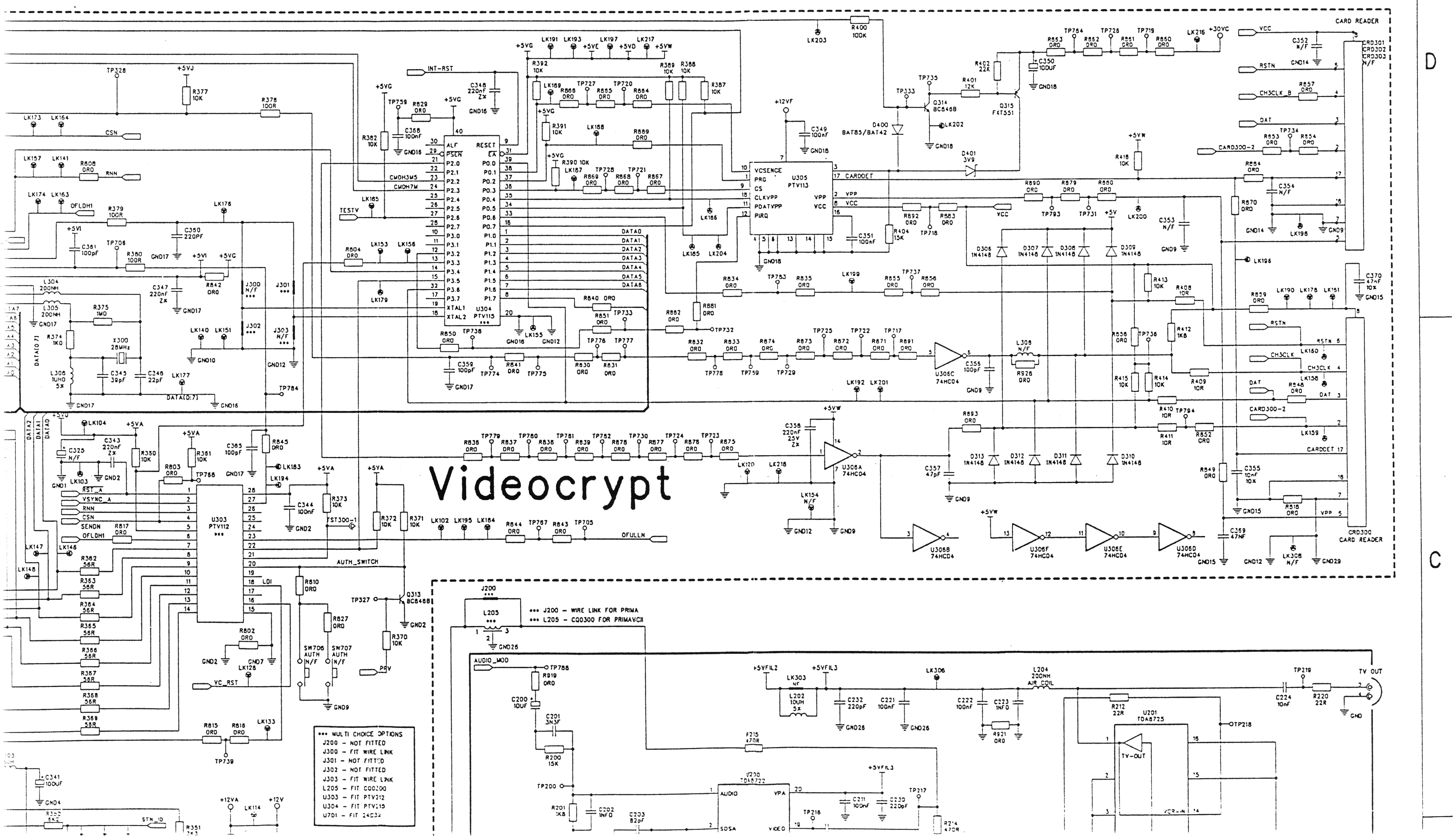
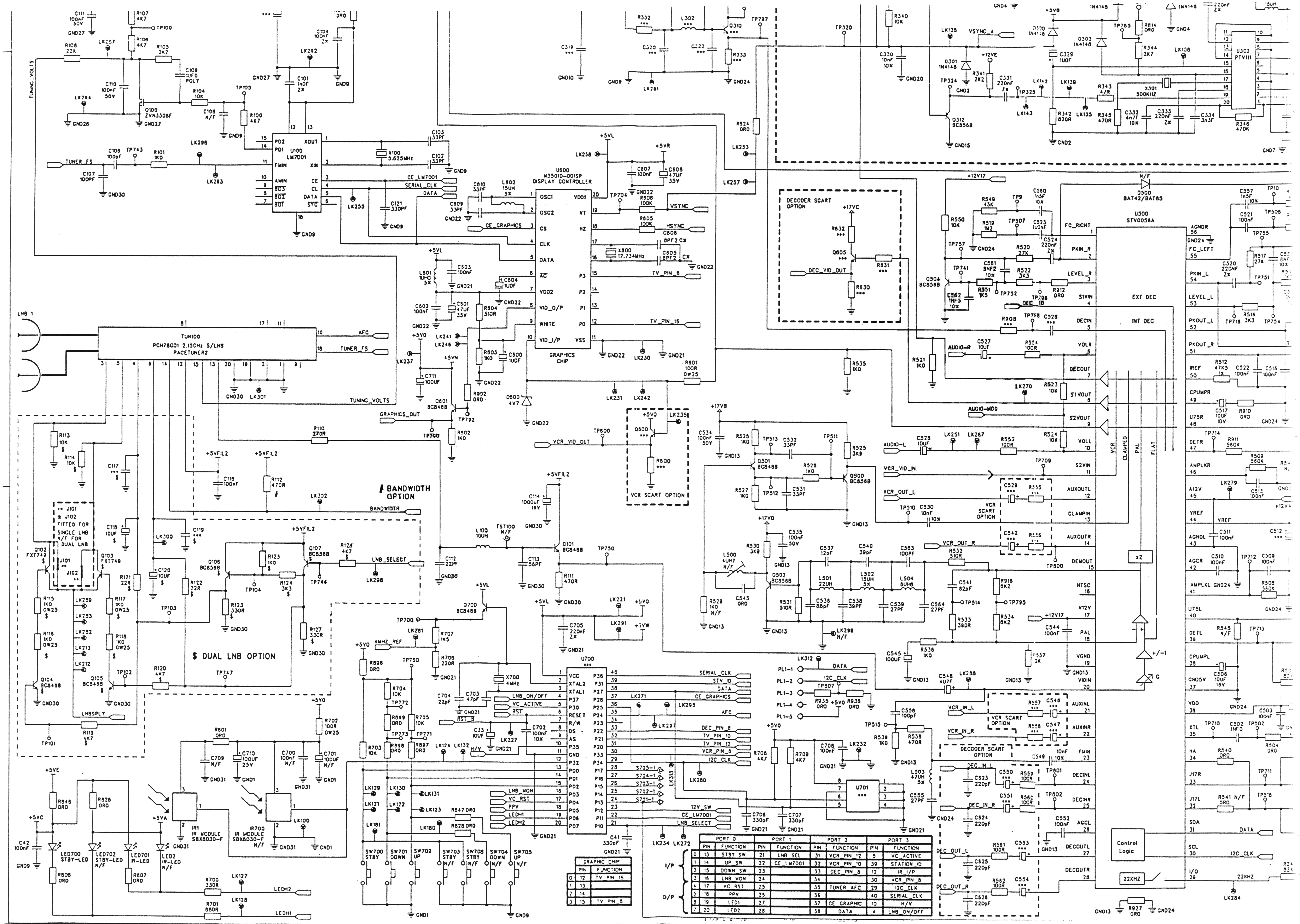
Revision Log

Rev	Date	Change Order	Drawn	Approved
A7G	09-10-97	P000743	D. Nar	

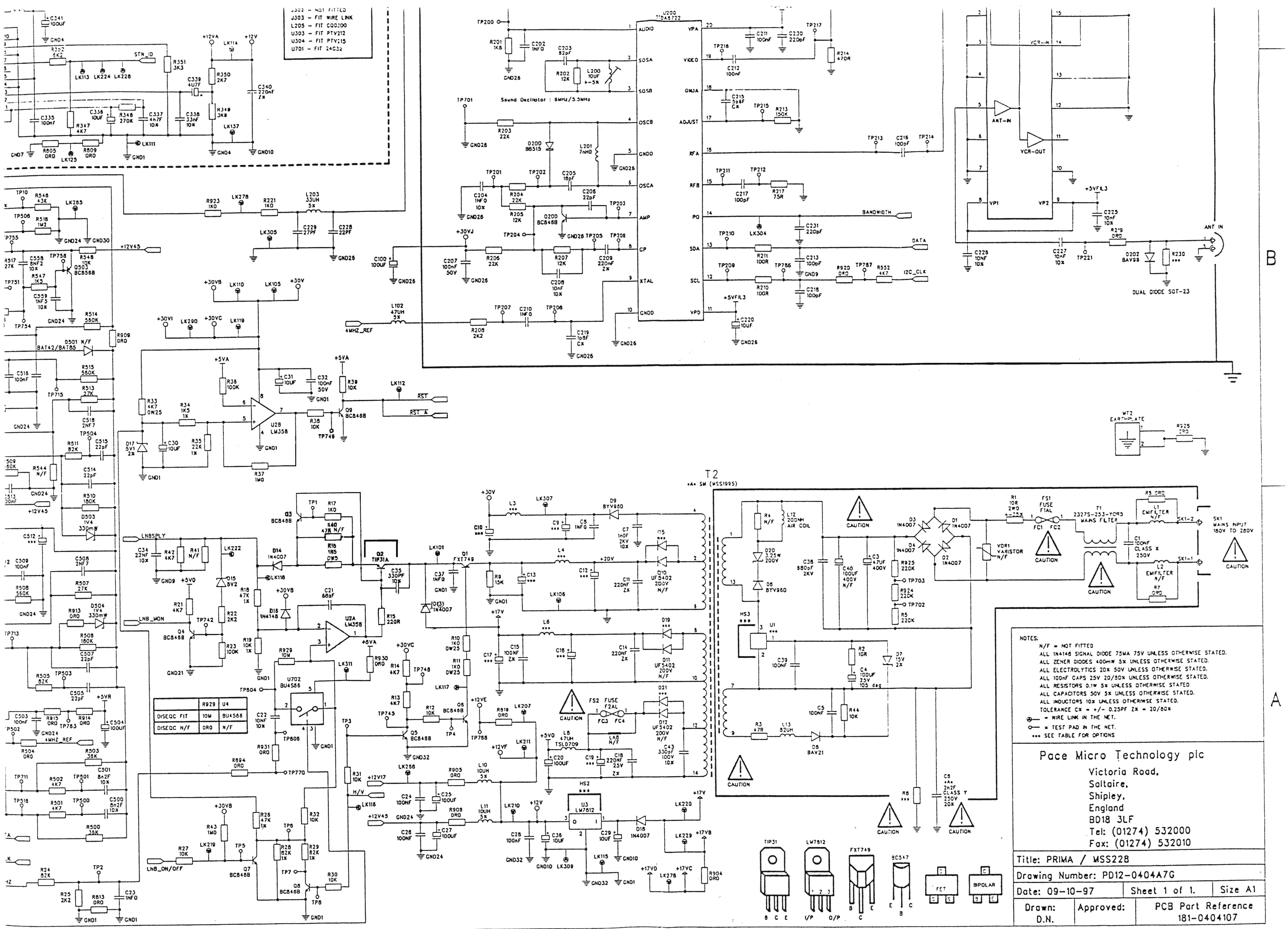

3
2
1
D
C
Videocrypt
CARD READER
CRD301
CRD302
CRD303
N/F
CRD300
CARD READER
U303
PTV112
U304
PTV115
U305
PTV113
U306A 74HC04
U306B 74HC04
U306C 74HC04
U306D 74HC04
U306E 74HC04
U306F 74HC04
X300 28MHz
Q313 BC848B
Q314 BC848B
Q315 FXT551
D400 BAT85/BAT42
D401 3V9
INT-RST
CSN
RNN
OFLDH1
TESTV
CMDH3M5
CMDH7M
DATA0
DATA1
DATA2
DATA3
DATA4
DATA5
DATA6
DATA7
DATA(0:7)
RST_A
VSYNC_A
SENDN
AUTH_SWITCH
TST300-1
OFULLN
YC_RST
PRV
SW706 AUTH N/F
SW707 AUTH N/F
VCC
RSTN
CH3CLK
DAT
CARD300-2
CARDDET
VPP
+30VC
+12VF
+5VW
STN_ID
*** J200 - WIRE LINK FOR PRIMA
*** L205 - CQ0300 FOR PRIMAVCII
AUDIO_MOD
U200 TDA8722
AUDIO
VPA
SOSA
VIDEO
U201 TDA8725
TV-OUT
VCR-IN
L204 200NH AIR COIL
TV OUT

*** MULTI CHOICE OPTIONS
J200 - NOT FITTED
J300 - FIT WIRE LINK
J301 - NOT FITTED
J302 - NOT FITTED
J303 - FIT WIRE LINK
L205 - FIT CQ0300
U303 - FIT PTV212
U304 - FIT PTV215
U701 - FIT 24C32


TUN100
PCH78G01 2.15GHz S/LNB
PACETUNER2
LNB 1
U100
LM7001
X100
5.625MHz
U600
M35010-001SP
DISPLAY CONTROLLER
GRAPHICS CHIP
X800
17.734MHz
U700
X700
4MHz
U500
STV0056A
U302
PTV111
X301
500KHZ
U701
TUNING_VOLTS
TUNER_FS
AFC
CE_LM7001
SERIAL_CLK
DATA
VSYNC
HSYNC
CE_GRAPHICS
TV_PIN_8
TV_PIN_16
GRAPHICS_OUT
VCR_VID_OUT
BANDWIDTH
LNB_SELECT
LNBSPLY
/ BANDWIDTH OPTION
$ DUAL LNB OPTION
** J101 & J102 FITTED FOR SINGLE LNB N/F FOR DUAL LNB
VCR SCART OPTION
DECODER SCART OPTION
DEC_VID_OUT
EXT DEC
INT DEC
AUDIO-R
AUDIO-MOD
AUDIO-L
VCR_VID_IN
VCR_OUT_L
VCR_OUT_R
VCR_IN_L
VCR_IN_R
DEC_IN_L
DEC_IN_R
DEC_OUT_L
DEC_OUT_R
VCR
CLAMPED
PAL
FLAT
x2
+/-1
G
Control Logic
22KHZ
IR1
IR MODULE
SBX8030-F
IR700
IR MODULE
SBX8030-F
N/F
LED700
STBY-LED
LED702
STBY-LED
N/F
LED701
IR-LED
LED2
IR-LED
N/F
SW700 STBY
SW701 DOWN
SW702 UP
SW703 STBY
SW708 STBY
SW704 DOWN
SW705 UP
LEDH1
LEDH2
LNB_MON
VC_RST
PPV
LNB_ON/OFF
VC_ACTIVE
RST
H/V
4MHZ_REF
SERIAL_CLK
STN_ID
CE_GRAPHICS
DEC_PIN_8
TV_PIN_10
TV_PIN_12
VCR_PIN_8
I2C_CLK
12V_SW
CE_LM7001
LNB_SELECT
PL1-1
PL1-2
PL1-3
PL1-4
PL1-5
DATA
I2C_CLK
SDA
SCL
22KHZ

	GRAPHIC CHIP	
	PIN	FUNCTION
0	12	TV PIN 15
1	13	
2	14	
3	15	TV PIN 5

		PORT 0		PORT 1		PORT 2		PORT 3	
		PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
I/P	0	13	STBY SW	21	LNB SEL	31	VCR PIN 12	5	VC ACTIVE
	1	14	UP SW	22	CE LM7001	32	VCR PIN 10	39	STATION ID
	2	15	DOWN SW	23		33	DEC PIN 8	12	IR I/P
	3	16	LNB MON	24		34		30	VCR PIN 8
O/P	4	17	VC RST	25		35	TUNER AFC	29	I2C CLK
	5	18	PPV	25		36		40	SERIAL CLK
	6	19	LED1	27		37	CE GRAPHIC	10	H/V
	7	20	LED2	28		38	DATA	4	LNB ON/OFF


U200
TDA8722
AUDIO
SOSA
SOSB
OSCB
GNDO
OSCA
AMP
CP
XTAL
GNDD
VPA
VIDEO
GNDA
ADJUST
RFA
RFB
PO
SDA
SCL
VPD
Sound Oscillator : 6MHz/5.5MHz
BANDWIDTH
DATA
I2C_CLK
4MHZ_REF
ANT-IN
VCR-OUT
VCR-IN
ANT IN
DUAL DIODE SOT-23
STN_ID
LNBSPLY
LNB_MON
LNB_ON/OFF
RST
RST_A
U2B LM358
U2A LM358
U702 BU4S66
T2
MT2 EARTH-PLATE
SK1 MAINS INPUT 180V TO 280V
FS1 FUSE F1AL
FS2 FUSE F2AL
T1 2327S-253-YCR5 MAINS FILTER
VDR1 VARISTOR N/F
L1 EMIFILTER N/F
L2 EMIFILTER N/F
C1 100NF CLASS X 250V
C6 2n2F CLASS Y 250V 20%
U3 LM7812
CAUTION
TIP31
LM7812
FXT749
BC547
FET
BIPOLAR
B C E
I/P O/P
B
A

J302 - NOT FITTED
J303 - FIT WIRE LINK
L205 - FIT CO0200
U303 - FIT PTV212
U304 - FIT PTV215
U701 - FIT 24C32

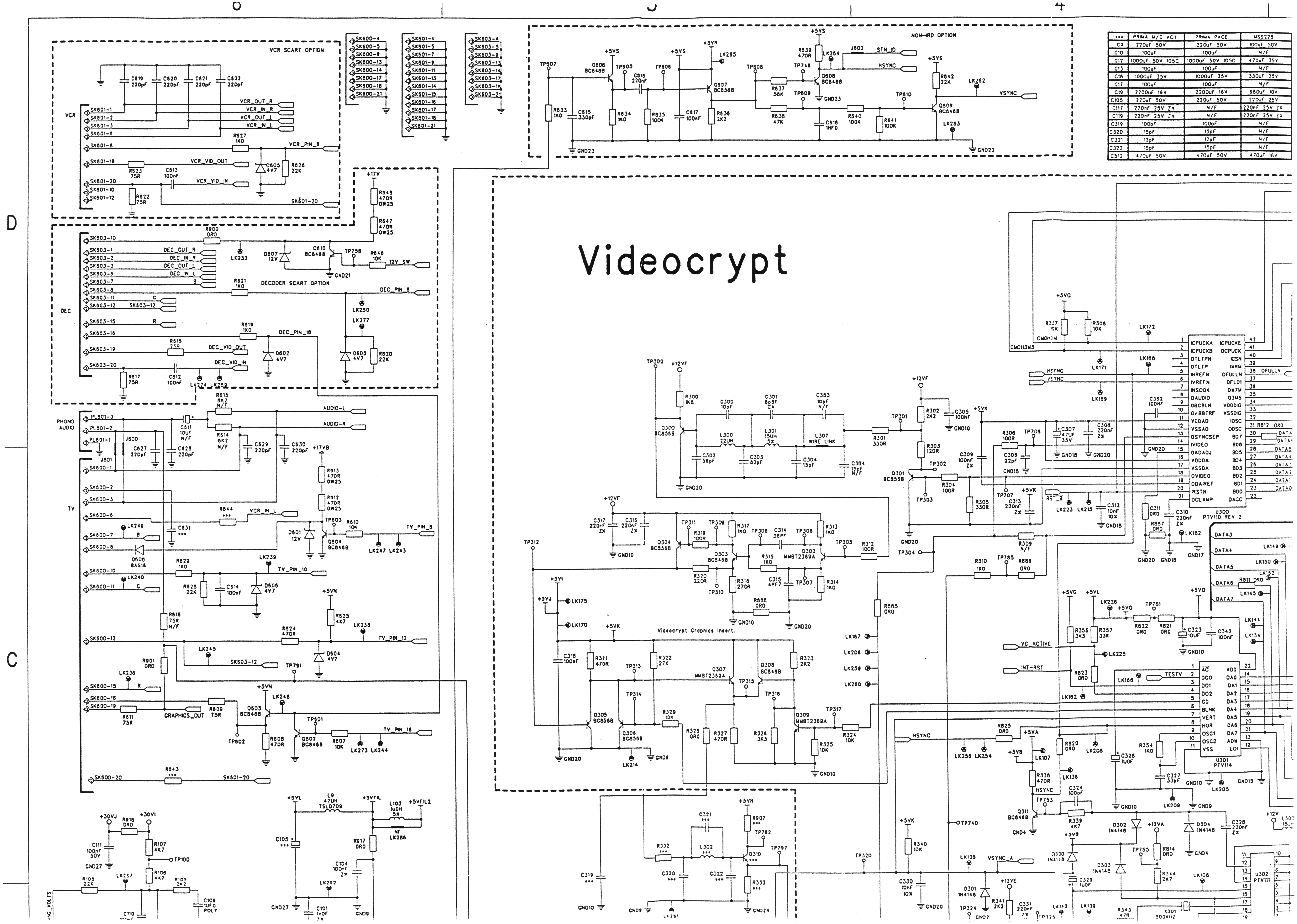
	R929	U4
DISEQC FIT	10M	BU4S66
DISEQC N/F	0R0	N/F

NOTES:
N/F = NOT FITTED
ALL 1N4148 SIGNAL DIODE 75MA 75V UNLESS OTHERWISE STATED.
ALL ZENER DIODES 400mW 5% UNLESS OTHERWISE STATED.
ALL ELECTROLYTICS 20% 50V UNLESS OTHERWISE STATED.
ALL 100nF CAPS 25V 20/80% UNLESS OTHERWISE STATED.
ALL RESISTORS 0.1W 5% UNLESS OTHERWISE STATED.
ALL CAPACITORS 50V 5% UNLESS OTHERWISE STATED.
ALL INDUCTORS 10% UNLESS OTHERWISE STATED.
TOLERANCE C% = +/- 0.25PF Z% = 20/80%
⊗— = WIRE LINK IN THE NET.
○— = TEST PAD IN THE NET.
••• SEE TABLE FOR OPTIONS

Pace Micro Technology plc

Victoria Road,
Saltaire,
Shipley,
England
BD18 3LF
Tel: (01274) 532000
Fax: (01274) 532010

Title: PRIMA / MSS228		
Drawing Number: PD12-0404A7G		
Date: 09-10-97	Sheet 1 of 1.	Size A1
Drawn: D.N.	Approved:	PCB Part Reference 181-0404107


VCR SCART OPTION
VCR
DECODER SCART OPTION
DEC
PHONO AUDIO
TV
NON-IRD OPTION
Videocrypt Graphics Insert.
VCR_OUT_R
VCR_IN_R
VCR_OUT_L
VCR_IN_L
VCR_PIN_8
VCR_VID_OUT
VCR_VID_IN
DEC_OUT_R
DEC_IN_R
DEC_OUT_L
DEC_IN_L
DEC_PIN_8
DEC_PIN_16
DEC_VID_OUT
DEC_VID_IN
12V_SW
AUDIO-L
AUDIO-R
TV_PIN_8
TV_PIN_10
TV_PIN_12
TV_PIN_16
GRAPHICS_OUT
STN_ID
HSYNC
VSYNC
VC_ACTIVE
INT-RST
VSYNC_A
U300 PTV110 REV 2
U301 PTV114
U302 PTV111
D
C

Videocrypt

•••	PRIMA M/C VCII	PRIMA PACE	MSS228
C9	220uF 50V	220uF 50V	100uF 50V
C10	100uF	100uF	N/F
C12	1000uF 50V 105C	1000uF 50V 105C	470uF 35V
C13	100uF	100uF	N/F
C16	1000uF 35V	1000uF 35V	330uF 25V
C17	100uF	100uF	N/F
C19	2200uF 16V	2200uF 16V	680uF 10V
C105	220uF 50V	220uF 50V	220uF 25V
C117	220nF 25V Zx	N/F	220nF 25V Zx
C119	220nF 25V Zx	N/F	220nF 25V Zx
C319	100pF	100pF	N/F
C320	15pF	15pF	N/F
C321	12pF	12pF	N/F
C322	15pF	15pF	N/F
C512	470uF 50V	470uF 50V	470uF 16V